EPD-KNA-20230213-IBB1-EN

Silentboard GKF

KNAUF

ENVIRONMENTAL PRODUCT DECLARATION

as per *ISO 14025* and *EN 15804+A2*

Owner of the Declaration	Knauf Gips KG
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-KNA-20230213-IBB1-EN
Issue date	10.04.2024
Valid to	09.04.2029

Knauf Silentboard GKF

Knauf Gips KG

Institut Bauen und Umwelt e.V.

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ECO PLATFORM EPD VERIFIED

1. General Information

Knauf Gips KG

Programme holder

IBU – Institut Bauen und Umwelt e.V.
Hegelplatz 1
10117 Berlin
Germany

Declaration number

EPD-KNA-20230213-IBB1-EN

This declaration is based on the product category rules:

Plasterboard, 01.08.2021
(PCR checked and approved by the SVR)

Issue date

10.04.2024

Valid to

09.04.2029

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

Florian Pronold
(Managing Director Institut Bauen und Umwelt e.V.)

Knauf Silentboard GKF

Owner of the declaration

Knauf Gips KG
Am Bahnhof 7
97346 Iphofen
Germany

Declared product / declared unit

Plasterboard Knauf Silentboard Type GKF according to *DIN 18180* respectively DF according to *EN 520*, 1 m², board thickness 12.5 mm, weight of board 17.5 kg/m²

Scope:

This EPD covers 100 % of manufacture of the plasterboard Knauf Silentboard GKF. This plasterboard is manufactured in plant Iphofen (Germany). The life cycle assessment is based on production data for year 2022.
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.

The EPD was created according to the specifications of EN 15804+A2. In the following, the standard will be simplified as *EN 15804*.

Verification

The standard EN 15804 serves as the core PCR
Independent verification of the declaration and data according to ISO 14025:2011
☐ internally ☒ externally

Dr. Matthew Fishwick,
(Independent verifier)

2. Product

2.1 Product description/Product definition

Knauf Silentboard GKF is a gypsum board with a high weight per unit area and flexural ductility for enhanced sound insulation, consisting of a special gypsum core with a board liner cover.

For the placing on the market of the product in the European Union/European Free Trade Association (EU/EFTA) (with the exception of Switzerland) *Regulation (EU) No. 305/2011* applies. The product Knauf Silentboard GKF needs a declaration of performance taking into consideration *EN 520* and the CE-marking.

For the application and use the respective national provisions apply.

2.2 Application

Knauf Silentboard GKF sound shield boards are used in all interior fitting areas as cladding and for retrofitting drywalling systems to fire protection standards and the high sound protection specifications.

Knauf Silentboard GKF are suitable for the following systems:
- Metal stud partitions
- Furrings
- Suspended ceilings
- Room in a Room system Knauf Cubo
- Upgrading of existing walls

2.3 Technical Data

The following technical data in condition on delivery is relevant for the declared product:

Constructional data

Name	Value	Unit
Density acc. to DIN 18180	≥ 1400	kg/m³
Thermal conductivity following EN 12664	0.26	W/(mK)
Water vapour resistance factor μ dry acc. EN ISO 10456	10	-
Water vapour resistance factor μ wet acc. EN ISO 10456	4	-
Shrinkage and expansion per 1 % change of relative air humidity -	0.005 - 0.008	mm/m
Shrinkage and expansion per 1 Kelvin change of temperature -	0.013 - 0.02	mm/m
Flexural breaking load longitudinal direction acc. EN 520	≥ 725	N
Flexural breaking load transverse direction acc. EN 520	≥ 300	N

Further information is available in the technical data sheet *K717* Knauf Silentboard under www.knauf.com.

Performance data of the product in accordance with the declaration of performance with respect to its essential characteristics according to *EN 520*.

2.4 Delivery status

Plasterboards Knauf Silentboard GKF according to *DIN 18180* (Type DFR according to *EN 520*) are delivered with a board thickness of 12.5 mm as well as a size of 2500 or 2000 mm length, and 625 mm (width) with a half-rounded long edge (HRAK) and front cut square edge (SK).

2.5 Base materials/Ancillary materials

Knauf Silentboard GFK consists of a special gypsum core (> 90 %), covered with a board liner (< 3 %), containing small amounts (< 5 %) of starch, tensides, and fibre additives.

This product contains substances listed in the candidate list (23.01.2024) *ECHA2024* exceeding 0.1 percentage by mass: no.

This product contains other CMR substances in categories 1A or 1B of *Regulation (EC) No. 1272/2008* which are not on the candidate list, exceeding 0.1 percentage by mass: 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) Ordinance on Biocide Products No. 528/2012*): no

2.6 Manufacture

The manufacturing process for gypsum boards is shown in Figure 1.

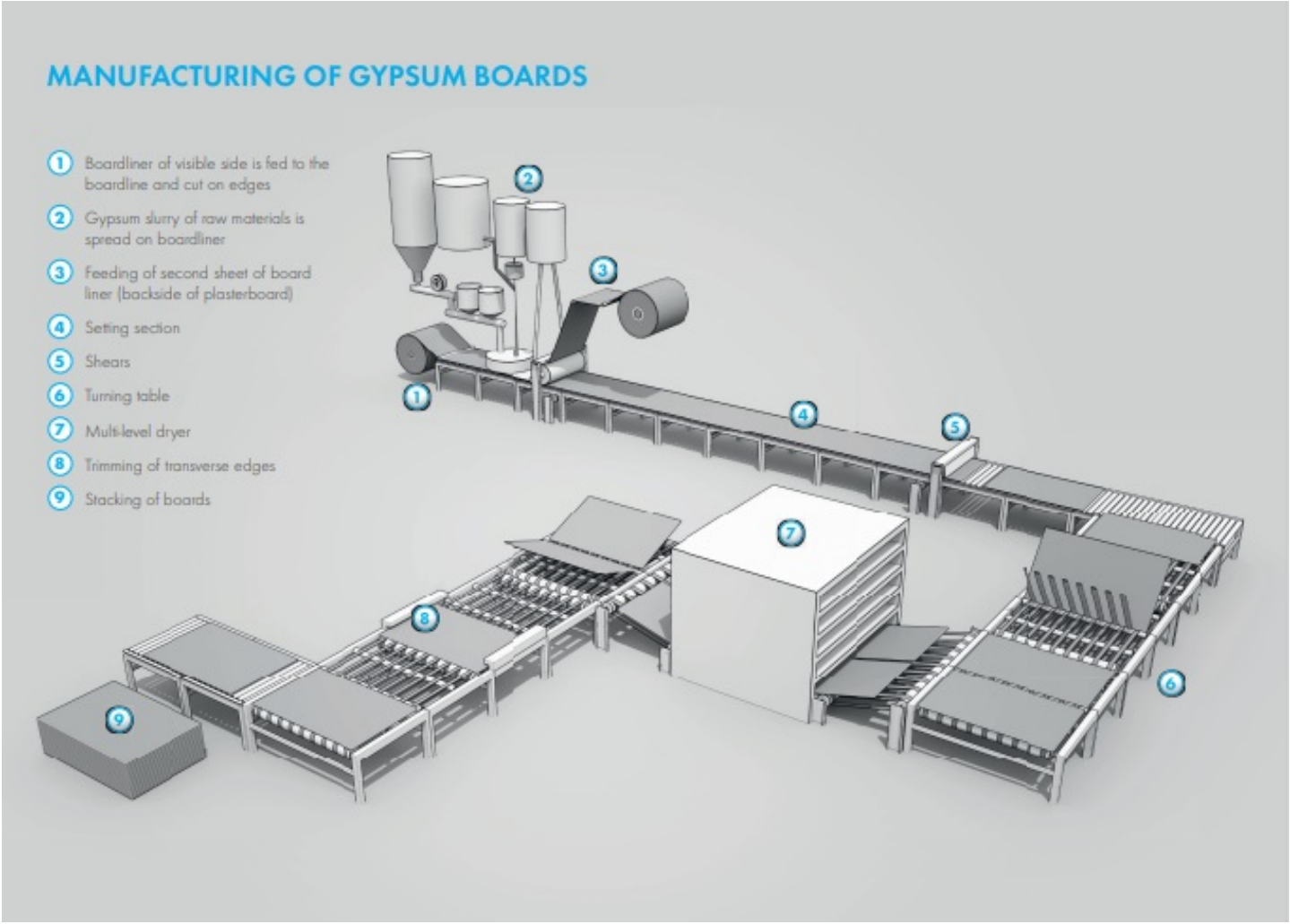

Figure 1: Manufacturing process of gypsum boards

The components of Knauf Silentboard GKF are suspended in water and spread on a continuous sheet of board liner (visible face, lower layer). Beforehand, the board liner is cut on the sides for edge shaping. The slurry is covered with a second sheet of board liner (back surface) in the forming station and the edges of the visible face board liner are flipped upwards. On the subsequent board line the gypsum sets continuously and is dried in a multi-level drier to the permitted residual moisture level. Drying is followed by the cutting of the boards to the desired lengths. All processes within the company are certified according to *ISO 9001*.

2.7 Environment and health during manufacturing

The production of Knauf Silentboard GKF is subject to the German emission control regulations *BImSchG*. Greenhouse gas emissions are measured due to CO_2 emissions trading.

The German manufacturing sites for the production of Knauf Silentboard GKF are certified according to *ISO 50001* as well as certified with the occupational safety standard 'Sicher mit System' (Systematic Safety) from the German trade association *BG RCI*.

Gypsum from the flue-gas desulphurization plants of coal-fired power stations is used in addition to natural gypsum. Production waste as well as dust from the filtration plants are recycled internally and fed back into the production of plasterboards.

2.8 Product processing/Installation

Storage

Knauf Silentboard GKF should be stored indoors under dust-free and dry conditions in a horizontal position.

Application

During application, dust thresholds are to be observed according to *TRGS 900* and *TRGS 559*. The application and installation should follow the instruction sheets provided under www.knauf.com, e.g., *SIB01* Knauf Silentboard Systems.

Endless filament glass fibres are used in the manufacturing of Knauf Silentboard GKF for enhanced fire protection. These fibres do not fan out during application and therefore no fibre dusts according to *TRGS 521* occurs.

2.9 Packaging

Plasterboards Knauf Silentboard GKF are stacked on reusable pallets and protected with a polyethylene (PE) film.

2.10 Condition of use

Knauf Silentboard sound shield boards are used in all interior fitting areas as cladding and for retrofitting drywalling systems to fire protection standards and the highest sound protection specifications. There is no alteration of the material composition during use.

2.11 Environment and health during use

High sound protection performance is especially provided in the low frequency range. By this, Knauf Silentboard GKF contributes to health protection and enhanced comfort inside buildings.

According to the emission test of Eurofins Product Testing A/S (*Eurofins2021*), no hazardous substances are emitted above permissible thresholds during use.

2.12 Reference service life

There was no reference service life determined according to *ISO 15686-1*. However, a service life of 50 years can be considered for gypsum plasterboards according to the Guideline for Sustainable Building *BBSR2017*. There are no influences on the ageing of Knauf Silentboard GKF during use when following the established engineering practice.

2.13 Extraordinary effects

Fire

The reaction to fire of Knauf Silentboard GKF is classified as follows according to *EN 520* in conjunction with *EN 13501-1*.

Fire protection

Name	Value
Building material class; fire behaviour class	A2
Smoke gas development; smoke production	s1
Burning droplets; flaming droplets/particles	d0

A2 = non-combustible
s1 = no smoke
d0 = no burning fall-off/drop-off

Water

Knauf Silentboard GKF show a small tendency to swell or shrink within changes of the climatic conditions. However, a permanent exposure to wet conditions or very high levels of relative humidity may lead to a decrease in strength. An instruction sheet about restoration of flood damage is available under www.knauf.com *BSDH2013*.

Mechanical destruction

Minor damages on plasterboards Knauf Silentboard GKF can be mended with suitable gypsum based filling materials. The installation with screws allows an easy exchange of heavily damaged boards. In this case, the substructure should be examined, too, and replaced if necessary.

2.14 Re-use phase

Re-use

Once plasterboards Knauf Silentboard GKF are installed, they are not suited for re-use in an unchanged way. Prior to collection, Knauf Silentboard GKF should be separated from other used building materials and pruned of foreign matter, e.g., metals from the substructure already on site for easier recycling or disposal.

Further use

Residual materials from new plasterboards Knauf Silentboard GKF, e.g., from cut waste at the building site, can be disposed of at a landfill.

Recycling

In principle, gypsum boards can be recycled by standard recycling processes. However, Knauf Silentboard GKF is currently not suited for recycling.

2.15 Disposal

Plasterboards Knauf Silentboard GKF have to be disposed of in compliance with the following waste codes of the *European Waste Catalogue*:

17 08 02 - gypsum-based construction materials other than those mentioned in 17 08 01
17 09 04 - mixed construction and demolition wastes other than those mentioned in 17 09 01, 17 09 02 and 17 09 03

National disposal guidelines have to be observed. In Germany, Knauf Silentboard GKF are to be disposed of at landfills of landfill category 1 or higher according to the regulation of landfills *DepV*.

2.16 Further information

Further information about Knauf Silentboard GKF, e.g., the technical data sheet or the product safety information sheet are available at www.knauf.com.

3. LCA: Calculation rules

3.1 Declared Unit

The declared unit is 1 m² of Knauf Silentboard GKF with a thickness of 12.5 mm, weight of approx. 17.5 kg/m².

Declared unit

Name	Value	Unit
Declared unit	1	m^2
Conversion factor to 1 kg	0.057	m²/kg
Grammage	17.5	kg/m^2
Layer thickness	0.0125	m

3.2 System boundary

The EPD is a declaration cradle to gate with options, modules C1–C4, and module D (A1–A3, C, D, and additional modules A4 and A5).

This Environmental Product Declaration according to EN 15804 contains:

- provision of raw materials and transport to plant, production of boards (A1-A3) including thermal energy for calcination and drying (from natural gas, geographic scope: DE), as well as electricity (residual mix DE) • transport to building site (A4)
- installation at building site (A5) including the incineration of transport packaging
- disassembly (C1)
- transport to recycling facility or landfill site (C2)
- landfilling at end of life (C4)
- credits in D from incineration with energy recovery of packaging material in A5

The life cycle of Knauf Silentboard GKF is outlined in Figure 2.

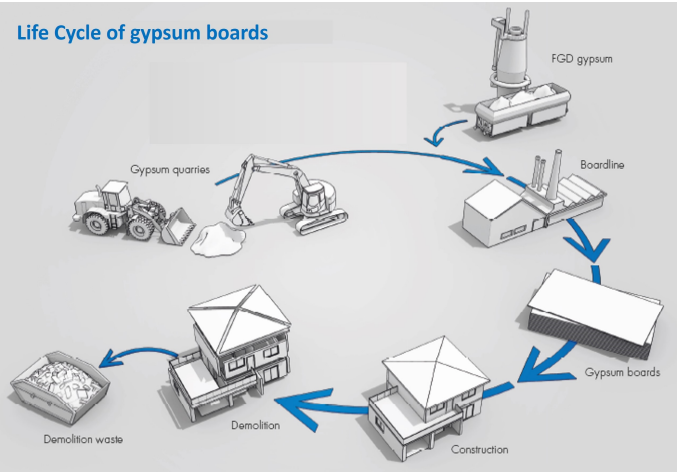

Figure 2: Principal life cycle of gypsum boards

3.3 Estimates and assumptions

Some raw material and additives were not available in the background database and therefore were either substituted with similar material or modelled with own processes.

For transport, a general payload of 50 % is assumed. Transport to the building site (module A4) as well as transport from the building site to the collecting site or landfill (module C2) is calculated with a standard distance of 100 km. These are not actual transport distances but shall facilitate the extrapolation to the 'real' distances on building level.

3.4 Cut-off criteria

All raw materials for the manufacturing of plasterboards Knauf Silentboard GKF, the required energy, water and the resulting emissions are considered in the life cycle assessment. That way, recipe components with a share even smaller than 1 % are included. All neglected processes contribute less than 5 % to the total mass or less than 5 % to the total energy consumption.

3.5 Background data

For modelling, the software *LCA for Experts* version 10.7.1.28 with the *Managed LCA content* version 2023.2 from Sphera was used. Data sets for Germany were used for the life cycle inventory as much as possible, especially for the provision of electricity and thermal energy.

3.6 Data quality

The LCA of Knauf Silentboard GKF was modelled by using datasets from Sphera's *Managed LCA content* database, exclusively. The used background data sets are no older than 5 years. Due to the substitution of materials which had to be considered in the LCA modelling, the overall data quality was evaluated as satisfactory.

3.7 Period under review

The modelling is based on the annual production of Knauf Silentboard GKF in production year 2022.

3.8 Geographic Representativeness

Land or region, in which the declared product system is manufactured, used or handled at the end of the product´s lifespan: Global

3.9 Allocation

Allocations are avoided in the modelling. Energy consumptions of different board types are monitored product specific. Therefore, no co-product allocation was required. Beyond that, allocations are only applied in the background data.

3.10 Comparability

Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to *EN 15804* and the building context, respectively the product-specific characteristics of performance, are taken into account.

4. LCA: Scenarios and additional technical information

Characteristic product properties of biogenic carbon

Biogenic carbon in product and packaging per 1 m² board according to EN 15804+A2

Name	Value	Unit
Biogenic carbon content in product	0.221	kg C
Biogenic carbon content in accompanying packaging	0.042	kg C

Note: 1 kg of biogenic carbon is equivalent to 44/12 kg of CO_2.

Product Stage (A1-A3)

Supply of raw materials (A1)
Knauf Silentboard GKF consists of a gypsum core and barytes which is reinforced with mineral fillers and covered with board liner. The natural gypsum is mainly extracted from open-cast mining in close vicinity to the manufacturing site. Furthermore, gypsum from the flue-gas desulphurization of coal-fired power stations (FGD gypsum) is used as a raw material. Board liner for the covering of gypsum core is produced from recycled waste paper which is certified by FSC and/or PEFC. Additives are added for an easier processing and a fine adjustment of properties of plasterboards Knauf Silentboard GKF. These additives add up to less than 5 %.

Transport of raw materials(A2)
Natural gypsum is extracted from mines close to the manufacturing sites of Knauf Silentboard GKF. Accordingly, transport distances are short and trucks can be used. FGD gypsum is transported by rail from coal-fired power plants. The heavy spar is produced predominantly in Germany and also delivered by truck. Baryte can also be delivered from overseas by container ship. Further raw materials are supplied by truck from manufacturers within Germany or from neighbouring countries.

Manufacturing (A3)
Natural gypsum and gypsum from the flue-gas desulphurization is calcinated prior to the mixing with other components. FGD gypsum is usually delivered as damp material and, thus, must be dried before calcination. Stucco, mineral fillers and additives are mixed with water and processed as described in section 2.6. The addition of water allows the incorporation of water of crystallization into the crystal lattice of calcium sulphate, i.e., gypsum becomes settled and hardened. Redundant surface water is removed in a multi-level dryer.

Transport to building site (A4)

For transport, a standard distance of 100 km by truck is assumed. This declaration facilitates the extrapolation of the results in A4 to the real distance.

Name	Value	Unit
Transport distance	100	km
Capacity utilisation (including empty runs)	50	%
Gross density of products transported	1400	kg/m^3

Assembly at building site (A5)

The installation in the building includes the electricity consumption for fastening the Knauf Silentboard GKF. Accessories such as screws or the substructure itself are not part of the LCA in this EPD. The energy consumption for the electrical devices was considered with 0.0018 kWh/m².

The waste material (0.892 kg/m²) from the construction site is transported by truck to a landfill and disposed of. The replacement of this construction waste is considered in A5 as well.

The packaging material, re-usable wooden pallets and PE-film, is incinerated. The credits from this process are reported in Module D.

Name	Value	Unit
Electricity consumption	0.0018	kWh
Material loss	0.892	kg

Use phase (B1-B7)
Excluded since no environmental impacts/benefits are expected. A service life of 50 years can be considered for gypsum plasterboards according to the Guideline for Sustainable Building BBSR2017.

End of life (C1-A4)
The demolition (C1) of the Knauf Silentboard GKF from the building is considered to be done 100 % manually. It was assumed that the deconstruction would take place without further processing of the waste.

For the transport (C2) from the demolition site to the landfill by truck, a distance of 100 km was assumed in the calculation.

Transport (C2)

Name	Value	Unit
Transport distance	100	km
Capacity utilisation (including empty runs)	50	%

Currently, Knauf Silentboard GKF is not recycled. Therefore, module C3 is declared with 0 impacts.

Disposal (C4) includes the disposal of 100 % Knauf Silentboard GKF at inert landfill.

Disposal (C4)

Name	Value	Unit
Collected separately	17.5	kg
Collected as mixed construction waste	-	kg
Reuse	-	kg
Recycling	-	kg
Energy recovery	-	kg
Landfilling	17.5	kg

Reuse-, recover- and recycling potential (D)
Module D contains only credits for exported energy from incineration of packaging material (results only from A5).

Name	Value	Unit
Incineration of the packaging material	100	%

5. LCA: Results

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

Product stage			Construction process stage		Use stage							End of life stage				Benefits and loads beyond the system boundaries
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	X	X	MND	MND	MNR	MNR	MNR	MND	MND	X	X	X	X	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT according to EN 15804+A2: 1 m² Knauf Silentboard GKF 12.5 mm; approx. 17.5 kg/m²

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
GWP-total	kg CO_2 eq	1.4E+00	1.5E-01	3.2E-01	0	1.5E-01	0	1.06E+00	-5.45E-02
GWP-fossil	kg CO_2 eq	2.36E+00	1.46E-01	1.61E-01	0	1.46E-01	0	2.64E-01	-5.42E-02
GWP-biogenic	kg CO_2 eq	-9.54E-01	2.12E-03	1.58E-01	0	2.12E-03	0	7.94E-01	-2.48E-04
GWP-luluc	kg CO_2 eq	2.84E-03	1.36E-03	3.22E-04	0	1.36E-03	0	8.32E-04	-3.54E-06
ODP	kg CFC11 eq	1.77E-11	2.3E-14	9.51E-13	0	2.3E-14	0	6.89E-13	-4.27E-13
AP	mol H^+ eq	4.37E-03	1.93E-04	3.64E-04	0	1.93E-04	0	1.9E-03	-6.79E-05
EP-freshwater	kg P eq	1.76E-05	5.38E-07	9.71E-07	0	5.38E-07	0	5.41E-07	-8.81E-08
EP-marine	kg N eq	1.39E-03	6.77E-05	1.1E-04	0	6.77E-05	0	4.91E-04	-1.99E-05
EP-terrestrial	mol N eq	1.41E-02	7.94E-04	1.18E-03	0	7.94E-04	0	5.4E-03	-2.13E-04
POCP	kg NMVOC eq	3.36E-03	1.67E-04	2.83E-04	0	1.67E-04	0	1.48E-03	-5.53E-05
ADPE	kg Sb eq	2.1E-07	9.87E-09	1.24E-08	0	9.87E-09	0	1.24E-08	-3.9E-09
ADPF	MJ	3.84E+01	2.02E+00	2.36E+00	0	2.02E+00	0	3.57E+00	-1E+00
WDP	m^3 world eq deprived	6.98E-02	1.84E-03	2.5E-02	0	1.84E-03	0	2.93E-02	-5.18E-03

GWP = Global warming potential; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential of land and water; EP = Eutrophication potential; POCP = Formation potential of tropospheric ozone photochemical oxidants; ADPE = Abiotic depletion potential for non-fossil resources; ADPF = Abiotic depletion potential for fossil resources; WDP = Water (user) deprivation potential)

RESULTS OF THE LCA - INDICATORS TO DESCRIBE RESOURCE USE according to EN 15804+A2: 1 m² Knauf Silentboard GKF 12.5 mm; approx. 17.5 kg/m²

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
PERE	MJ	1.05E+01	1.47E-01	2.53E+00	0	1.47E-01	0	5.84E-01	-2.92E-01
PERM	MJ	7.71E+00	0	-1.55E+00	0	0	0	0	0
PERT	MJ	1.82E+01	1.47E-01	9.73E-01	0	1.47E-01	0	5.84E-01	-2.92E-01
PENRE	MJ	3.81E+01	2.03E+00	2.57E+00	0	2.03E+00	0	3.57E+00	-1E+00
PENRM	MJ	2.97E-01	0	-2.1E-01	0	0	0	0	0
PENRT	MJ	3.84E+01	2.03E+00	2.36E+00	0	2.03E+00	0	3.57E+00	-1E+00
SM	kg	3.59E-01	0	0	0	0	0	0	0
RSF	MJ	0	0	0	0	0	0	0	0
NRSF	MJ	0	0	0	0	0	0	0	0
FW	m^3	1.32E-02	1.64E-04	1.19E-03	0	1.64E-04	0	9E-04	-2.36E-04

PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used as raw materials; PENRT = Total use of non-renewable primary energy resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water

RESULTS OF THE LCA – WASTE CATEGORIES AND OUTPUT FLOWS according to EN 15804+A2: 1 m² Knauf Silentboard GKF 12.5 mm; approx. 17.5 kg/m²

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
HWD	kg	3.5E-09	1.04E-11	1.8E-10	0	1.04E-11	0	7.69E-11	-5.32E-11
NHWD	kg	5.1E-01	3.13E-04	9.23E-01	0	3.13E-04	0	1.79E+01	-4.95E-04
RWD	kg	9.29E-04	3.96E-06	5.34E-05	0	3.96E-06	0	4.01E-05	-7.74E-05
CRU	kg	0	0	0	0	0	0	0	0
MFR	kg	0	0	0	0	0	0	0	0
MER	kg	0	0	0	0	0	0	0	0
EEE	MJ	0	0	2.58E-01	0	0	0	0	0

EET	MJ	0	0	4.64E-01	0	0	0	0	0

HWD = Hazardous waste disposed; NHWD = Non-hazardous waste disposed; RWD = Radioactive waste disposed; CRU = Components for re-use; MFR = Materials for recycling; MER = Materials for energy recovery; EEE = Exported electrical energy; EET = Exported thermal energy

RESULTS OF THE LCA – additional impact categories according to EN 15804+A2-optional: 1 m² Knauf Silentboard GKF 12.5 mm; approx. 17.5 kg/m²

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
PM	Disease incidence	2.15E-07	1.41E-09	1.23E-08	0	1.41E-09	0	2.34E-08	-5.76E-10
IR	kBq U235 eq	1E-01	5.81E-04	6.04E-03	0	5.81E-04	0	4.56E-03	-1.29E-02
ETP-fw	CTUe	9.79E+00	1.44E+00	7.56E-01	0	1.44E+00	0	1.93E+00	-1.4E-01
HTP-c	CTUh	5.69E-10	2.92E-11	4.86E-11	0	2.92E-11	0	3E-10	-1.11E-11
HTP-nc	CTUh	3.37E-08	1.3E-09	3.52E-09	0	1.3E-09	0	3.16E-08	-2.73E-10
SQP	SQP	3.74E+01	8.37E-01	2.02E+00	0	8.37E-01	0	9E-01	-1.92E-01

PM = Potential incidence of disease due to PM emissions; IR = Potential Human exposure efficiency relative to U235; ETP-fw = Potential comparative Toxic Unit for ecosystems; HTP-c = Potential comparative Toxic Unit for humans (cancerogenic); HTP-nc = Potential comparative Toxic Unit for humans (not cancerogenic); SQP = Potential soil quality index

Disclaimer 1 – for the indicator “Potential Human exposure efficiency relative to U235”. This impact category deals mainly with the eventual impact of low dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator.

Disclaimer 2 – for the indicators “abiotic depletion potential for non-fossil resources”, “abiotic depletion potential for fossil resources”, “water (user) deprivation potential, deprivation-weighted water consumption”, “potential comparative toxic unit for ecosystems”, “potential comparative toxic unit for humans – cancerogenic”, “Potential comparative toxic unit for humans - not cancerogenic”, “potential soil quality index”. The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.

6. LCA: Interpretation

In general, the highest environmental impacts of Knauf Silentboard GKF result from the product stage A1-A3 with the exception of non-hazardous waste disposed NHWD. For this indicator, module C4 and the disposal of the boards at inert landfill leads to the highest overall contribution.
In modules A1-A3, major contributions result from the provision of raw materials to the overall life cycle impacts of the product. Exceptions are Hazardous waste disposed HWD (approx. 9 %), Non-hazardous waste disposed NHWD (< 1 %), Potential soil quality index SQP (approx. 27 %), and Global Warming Potential land use and land use change GWP-luluc (approx. 14 %).

The non-hazardous waste disposed NHWD, is dominated by the disposal C4 by almost 92 %. This was expected since there is no recycling at end of life but a complete landfilling. The high contribution of C4 to GWP-t results from the emission of biogenic carbon incorporated in the plasterboard. Landfilling in C4 contributes also considerably to the impact categories Water deprivation potential WDP (24 %), Eutrophication – marine EP-m (23 %), Eutrophication – terrestrial (25 %), Photochemical ozone depletion potential POCP (27 %), Acidification potential AP (27 %), Human toxicity - cancer effects HTP-c (31 %), and Human toxicity – non-cancer effects HTP-nc (44 %).

Transports in A4 and in C2 cause only minor contributions to the overall life cycle impacts, due to assumed distances of 100 km in both modules. Exceptions are Ecotoxicity, freshwater ETP-fw (approx. 9 %) and the Global Warming Potential land use and land use change GWP-luluc (approx. 20 %).

Some small credits given in module D result from the incineration and recycling of packaging only. The disassembled product is landfilled after disassembly.

7. Requisite evidence

7.1 Leaching (sulphates and heavy metals)

Plasterboards Knauf Silentboard GKF show a leaching behaviour typical for gypsum-based building products *Dre2006*. That is why disposal is only allowed in landfills from landfill category 1 in Germany *DepV2021*.
Plasterboards Knauf Silentboard GKF are classified in water hazard class 1 (slightly water-hazardous) *AwSV*.

7.2 Radioactivity

According to *Geh2012* and *RP 112* dose values and radon concentrations of gypsum-based building products are below 0.3 mSv/a. Thus, they can be used without restrictions.

7.3 VOC emissions

According to the emission test from Eurofins Product Testing A/S, no hazardous substances are emitted above permissible thresholds during use *Eurofins2021*.

Test after 3 days (limit value)

Name	Value	Unit
TVOC	< 10	mg/m²
Total carcinogens	< 0.01	mg/m²

Test after 28 days (limit value)

Name	Value	Unit
TVOC	< 1.0	mg/m³
TSVOC	< 0.1	mg/m³
R (dimensionless)	< 1	-
Sum of VOC without NIK/LCI	< 0.1	mg/m³
Formaldehyde	< 0.1	mg/m³
Total carcinogens	< 0.001	mg/m³

VOC emission tests showed that Knauf Silentboard GKF significantly undercut the required thresholds.

8. References

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EN 13501-1
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