ENVIRONMENTAL PRODUCT DECLARATION

Nr 03-12/2023

Gypsum Plasterboards

Knauf sp. z o.o.

Owner of the EPD:	*Knauf sp. z o.o.*
Programme owner:	*Łukasiewicz Research Network - Institute of Ceramics and Building Materials*
Name of programme:	*Environmental Product Declaration – B2B*
Issued:	***11.12.2023***
Valid until:	***11.12.2028***

Łukasiewicz
Instytut Ceramiki
i Materiałów Budowlanych

ENVIRONMENTAL PRODUCTS DECLARATION
Nr 03-12/2023

KNAUF

1. GENERAL INFORMATION

Owner of the EPD Knauf sp. z o.o.	**Products covered by the EPD:** Gypsum plasterboards: Knauf standard, impregnated, Akustik, fire resistant.
Programme owner: Łukasiewicz Research Network – Institute of Ceramics and Building Materials **http://www.icimb.pl/opole/**	**Owner of the EPD:** Knauf sp. z o.o. 25 Światowa St. 02-229 Warszawa Telephone: +48 22 36 95 100 e-mail: biuro@knauf.pl **https://www.knauf.pl/**
Date of issuance: 11.12.2023	**Declared product/declared unit:** The declared unit (DU) for the products is 1 m^2 (1 square meter) – gypsum plasterboards Knauf standard, impregnated, Akustik, fire resistant.
EPD valid until: 11.12.2028	**Scope:** The declaration covers the following products: ✓ Knauf plasterboards standard A10, A13 and A15, ✓ Knauf plasterboards impregnated HA13 and HA15, ✓ Knauf plasterboards Akustik, Akustik impregnated, Akustik Plus, ✓ Knauf plasterboards fire resistant F13 and F15 fire resistant impregnated HF13, fire resistant impregnated HF15, Diamant HF13. All manufactured in the Knauf Bełchatów sp. z o.o.; 3 Gipsowa St. 97-427 Rogowiec It contains information about the impact of the declared products on the environment. All data on the production cycle have been collected by Knauf sp. z o.o. from January 1,2022 to December 31, 2022 (12 months) and corresponded to the production's technology of that time. All data are averaged for total production of gypsum plasterboards – **standard** (A10, A13, A15), **impregnated** (HA13, HA15), **Akustik** (Akustik, Akustik impregnated, Akustik Plus), **fire resistant** (F13, F15, fire resistant impregnated HF13, HF15, Diamant HF13) produced by Knauf Bełchatów sp. z o.o. in Rogowiec. The life cycle assessment has been developed in accordance with the requirements of PN-EN ISO 15804+A2:2020, PN-EN ISO 14025 and PN-EN ISO 14040. The rules for product categorization have been adopted in accordance with the PN-EN 15804 standard. The declaration owner is responsible for the underlying information and evidence. Łukasiewicz Research Network – Institute of Ceramics and Building Materials Environmental Engineering Center in Opole is not responsible for the manufacturer's information and data and evidence regarding the life cycle assessment.

	Declarations resulting from different programs or performed not in accordance with the standard may not be compared.
Product Category Rules (PCR)	According to: PN-EN 15804+A2:2020-03 Sustainability of construction works. Environmental product declarations. Basic principles of categorization of construction products.
Representativeness:	Polish product, year 2022
Reference Service Life (RSL):	20 years
Reasons for performing LCA:	B2B
Life cycle Analysis (LCA):	LCA covers modules A1-A3, C1-C4 and D according to PN-EN 15804+A2 standard (Cradle-to-Gate with options)

Łukasiewicz Research Network – Institute of Ceramics and Building Materials, Environmental Engineering Center provides access to the type III EPD for gypsum plasterboards produced by Knauf sp. z o.o. to the interested parties.

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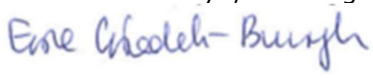
Director of the environmental engineering center

Ewa Głodek-Bucyk, PhD Eng.

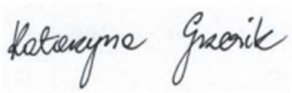


Leader of Process Engineering Research Group

Verification:

CEN PN-EN 15804+A2 standard serves as main PCR.
Independent EPD and data verification according to PN-EN ISO 14025:2010 standard.

☐ internal ☒ external



Katarzyna Grzesik, PhD Eng.

2. INFORMACJE O PRODUCENCIE I PRODUKTACH

Knauf sp. z o. o. has been operating in Poland in the construction industry for 25 years. Obtaining during this time a leading position on the Polish market in the field of construction materials. Knauf sp. z o. o. offers a wide range of products used in drywall systems based on gypsum plasterboard, floor systems, insulation systems with facade plasters and paints, and plastering systems including joint compounds. Gypsum plasterboard consists mainly of desulfogypsum, which is gypsum derived from the flue gas desulfurization process, as well as various additives that impart performance properties to the finished product. Gypsum boards from Knauf sp. z o. o. is ready for use indoors as cladding in metal-frame partition wall drywall systems, suspended ceilings, plumbing shaft walls, attic buildings, and drywall.

Caring for the environment is one of the company's most important foundations. The company is ISO 45001 and ISO 9001 certified, and product quality is confirmed by tests in accredited laboratories.

The company is committed to innovation, constantly seeking new avenues of development, and developing products to best meet the needs of their users.

The group of products covered by the declaration is gypsum plasterboards:

- **Knauf standard: (A10, A13, A15),**
- **Knauf impregnated:(HA13, HA15),**
- **Knauf Akustik: (Akustik, Akustik impregnated, Akustik Plus),**
- **Knauf fire resistant: fire resistant (F13, F15, fire resistant impregnated HF13 and HF15, Diamant HF13).**

The indicative composition of the products covered by the declaration is presented in the table below:

Material	Mass fraction [%]
Gypsum (desulfogypsum)	95
Cardboard covers	4-5
Additives modifying	<1

The production process for gypsum plasterboard involves transporting desulfogypsum generated in the wet-lime flue gas desulfurization process at PGE GiEK in Belchatow to the Knauf site via a conveyor belt system. The gypsum is then stored or directly transferred to the drying and calcination process. The gypsum thus prepared is cooled and stored in silos. A further process involving the batching of dry and wet ingredients takes place at the raw material storage and preparation station. The next step is the preparation of gypsum slurry by mixing two streams of components in a continuous mixer.

The resulting gypsum slurry is transferred to the cardboard surface, where it is spread, forming an initial gypsum cardboard web. The formed web is transported by a system of conveyor belts, while the one that does not meet the standards is recycled and goes in the form of dry mass to the mixer. After obtaining the basic mechanical parameters, the ribbon is pre-cut and then transported to the cross-dryer. Thus prepared gypsum plasterboards go to the saw system station, where they are cut to the final size, and then placed on pallets, which go to the warehouse of finished products.

The technological diagram of the production process of the gypsum plasterboards is shown below:

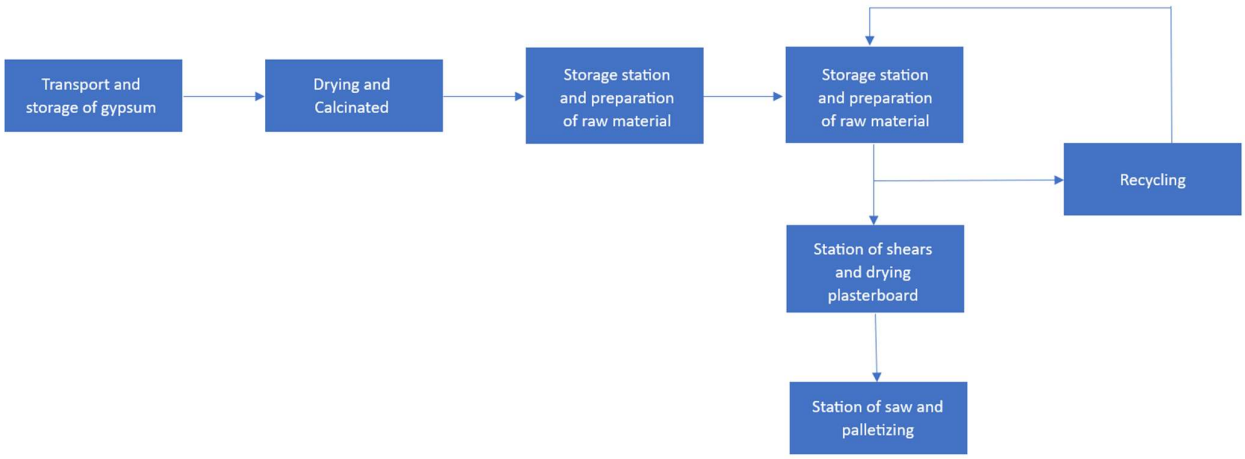


Fig. 1: The production diagram of plasterboards by Knauf sp. z o.o

KNAUF PLASTERBOARD STANDARD A10 - it is designed for use indoors as cladding in drywall systems. It has a longitudinal edge HRAK and a transverse edge SK. It retains its functionality in air humidity conditions below 70%. It can be used, among other things, in partition wall systems on metal and wooden frames, drywall, plumbing shaft walls, for suspended ceilings. The board also gives the option of making curved as well as broken elements.

KNAUF PLASTERBOARD STANDARD A13 - it is used for interior spaces as a drywall cladding. It is characterized by a longitudinal HRAK edge and a transverse SK edge. Its ease of processing allows it to be used in, among other systems: drywall, attic development, pre-wall, metal frame partition walls. It can be used in humidity conditions below 70%. The boards can be purchased in 7 available packages, of different lengths, two of them also of smaller width. In the case of boards with a length of 2000 mm, they have an additional chamfered transverse edge.

KNAUF PLASTERBOARD STANDARD A15 – it is used for interiors as cladding in drywall systems. It has an SK transverse edge and a HRAK longitudinal edge. The board's ease of processing allows it to make broken elements after it has been milled, and it can be used, among other things, in bay ceiling systems, partition wall systems, metal framing, plumbing shaft walls and attic buildings. The board can function in humidity conditions below 70%.

KNAUF PLASTERBOARD IMPREGNATED HA13 - is designed for indoor use as cladding in drywall systems. It has hydrophobic properties and is impregnated with ingredients that reduce moisture absorption and fungicidal substances. The board can be used for wet rooms in apartments and public buildings. It can be used in attic building systems, partition walls on wooden and metal frames, suspended ceilings, drywall. It retains its functionality at periodically increased humidity up to 85% for 10 hours a day.

KNAUF PLASTERDBOARD IMPREGNATED HA15 – is used indoors as cladding in drywall systems. The boards can be used in bathrooms, shower rooms and other wet rooms. Due to impregnation of the gypsum core with ingredients that reduce moisture absorption, soakability is reduced. In addition, the cardboard was protected with fungicidal substances. Thanks to the technologies used, the board retains its function during periodically elevated air humidity up to 85% for 10 hours a day. It can be used, among other things, in partition wall systems on metal and wooden frames, drywall, walls of installation shafts, suspended ceilings

KNAUF PLASTERBOARD AKUSTIK - using a special resilient gypsum core, it can be used in all drywall systems with the required increased sound insulation. It is characterized by a longitudinal HRAK edge and a transverse SK edge. It retains its functionality in air humidity conditions below 70%. It can be used, among other things, in bay ceiling systems, metal frame partition wall systems, plumbing shaft walls and attic buildings.

KNAUF PLASTERBOARD AKUSTIK IMPREGNATED - is a full acoustic board in which a special resilient gypsum core is used. It is used in all drywall systems with the required increased sound insulation. It has a transverse SK edge and a longitudinal HRAK edge. Thanks to the technologies used, the board retains its function during periodically increased humidity up to 85% for 10 hours a day. It can be used in attic building systems, partition walls on wooden and metal frames, suspended ceilings, drywall.

KNAUF PLASTERBOARD AKUSTIK PLUS – board uses a special resilient gypsum core that allows it to be used in all drywall systems where increased acoustic insulation is required. It is characterized by the SK transverse edge and HRAK longitudinal edge. It can be used in air humidity conditions below 70%, in attic building systems, partition walls on wooden and metal frames, suspended ceilings, drywall.

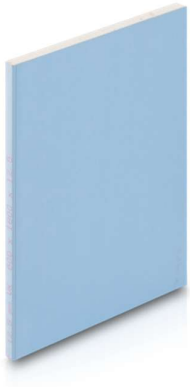
KNAUF PASTERBOARD FIRE RESISTANT F13 - in board uses a special gypsum core enriched with fiberglass that allows it to be used in all drywall systems where fire resistance is required. It retains its functionality in air humidity conditions below 70%, and can be used, among others, in attic development systems, partition walls on wooden and metal frames, suspended ceilings, drywall, walls of installation shafts. It is characterized by SK transverse edge and HRAK longitudinal edge.

KNAUF PLASTERBOARD FIRE RESISTANT F15 - thanks to the very good cohesion of the board's core and its enrichment with glass fiber, it can be used for drywall systems with the required fire resistance. It has an SK transverse edge and a HRAK longitudinal edge. The properties it retains in conditions of humidity below 70%, it can be installed, among other things, in partition wall systems on wooden and metal frames, attic development suspended ceilings, drywall, pre-walls.

KNAUF PLASTERBOARD FIRE RESISTANT IMPREGNATED HF13 - combines the advantages of impregnated board and fireproof board. The gypsum core used is enriched with glass fiber, additionally protected with agents that reduce moisture absorption. The cardboard itself is impregnated with fungicidal substances. It retains its properties in conditions of increased humidity, i.e., up to 85% for 10 hours a day. It is used for interior use as cladding in drywall systems. Among other things, it can be installed in metal and wood frame partition wall systems, drywall, plumbing shaft walls, suspended ceilings. It has an SK transverse edge and a HRAK longitudinal edge.

KNAUF GYPSUM PASTERBOARD FIRE RESISTANT IMPREGNATED HF15 – is an ideal solution for wet rooms where fireproofing is required. The cardboard has been impregnated with fungicidal substances, while, the gypsum core is enriched with fiberglass, which is additionally treated with agents that reduce moisture absorption. It has an SK transverse edge and a HRAK longitudinal edge. Thanks to the technologies used, it retains its properties in conditions of increased humidity, i.e. up to 85% for 10 hours a day. It is installed in interior drywall systems as a lining. It can be used in attic development systems, partition walls on wooden and metal frames, suspended ceilings, drywall.

KNAUF PLASTERBOARD DIAMANT HF13 – is a board with increased surface hardness, impact strength and sound insulation. Through the use of a fiberglass core, the board is fireproof. Thanks to its low absorbency, it is suitable for use in rooms with periodically higher humidity, i.e. up to 85% for 10 hours a day. Knauf Diamant is used as a cladding in drywall systems, which are building components with high requirements for: fire protection, operation in terms of mechanical loads, rigidity of the system. It is characterized by the SK transverse edge and HRAK longitudinal edge.



A summary of the technical data for the gypsum boards is given in Table 1.

Table 1- Basic properties of gypsum plasterboards in accordance with the Declarations of Performance (DoP) produced by Kanauf Sp.z o.o.

Gypsum plasterboards Knauf	Type	Thickness [mm]	Weight [kg/m²]	Density [kg/m³]	Reaction to Fire	Vapour-permeability Coefficiency [μ]	Bending strenght longitudinal direction [N]	Bending strenght transverse direction [N]
STANDARD A10	A	9,5	ca.6.3	ca.663	A2-s1,d0	10	≥400	≥160
STANDARD A13	A	12,5	ca.7,1	ca.568	A2-s1,d0	10	≥550	≥210
STANDARD A15	A	15	ca.10,3	ca.687	A2-s1,d0	10	≥650	≥250
IMPREGNATED HA13	H2	12,5	ca.7,6	ca.608	A2-s1,d0	10	≥550	≥210
IMPREGNATED HA15	H2	15	ca.11,3	ca.750	A2-s1,d0	10	≥650	≥250
AKUSTIK	A	12,5	ca.9,2	ca.736	A2-s1,d0	10	≥550	≥210
AKUSTIK IMPREGNATED	H2	12,5	ca.9,2	ca.736	A2-s1,d0	10	≥550	≥210
AKUSTIK PLUS	D	12,5	ca.13,5	ca.1040	A2-s1,d0	10	≥550	≥210
FIRE RESISTANT F13	DF	12,5	ca.10,2	ca.816	A2-s1,d0	10	≥550	≥210
FIRE RESISTANT F15	DF	15	ca.13	ca.867	A2-s1,d0	10	≥650	≥250
IMPREGNATED FIRE RESISTANT HF13	DFH2	12,5	ca.10,2	ca.816	A2-s1,d0	10	≥550	≥210
IMPREGNATED FIRE RESISTANT HF15	DFH2	15	ca.13	ca.867	A2-s1,d0	10	≥650	≥250
DIAMANT HF13	DFH1IR	12,5	ca.12,8	ca.1024	A2-s1,d0	≤9	≥725	≥300

3. LCA: CACULATION RULES

System boundaries

The life cycle analysis of the tested products includes A1-A3, A4 - A5, C1-C4 and D (Cradle to Gate with options) modules in accordance with PN-EN 15804. It includes the following modules:

- A1 – extraction and preparation of raw materials, generation of electricity and energy carriers for auxiliary processes,
- A2 – transport of raw materials to the production plant gate,
- A3 – production, including ancillary processes and emissions,
- A4 – transport to the building site,
- A5 – installation into the building,
- C1 – deconstruction/demolition,
- C2 – transport to waste treatment site,
- C3 – waste treatment,
- C4 – waste management,
- D – re-use potential.

Data collection period

Data on the production process was collected in the years 2022 (in the period 01.01.22 to 31.12.22).

Declared unit (DU)

Due to minor differences in the production process and product characteristics, the unit declared is 1 m^2 gypsum plasterboard – standard, impregnated, Akustik, fire resistant produced by Knauf Sp. z o.o. in Rogowiec.

Assumptions

A1 – extraction and consumption of raw materials refers to specific mass shares in the production process per unit of the declared product,

A2 – distances from raw material extraction to production plant individual for each raw material, means of transport differentiated by mode of delivery of raw materials,

A3 – values of CO_2, NO_x, SO_2, dust and other emissions from the production process obtained from measurements carried out at the site, others estimated on the basis of fuel consumption,

A4 - transport is carried out by trucks with a capacity of 16-32 tonnes, meeting EURO 6 emission standards, average distance from the plant to the customer 400 km,

A5 - consumption of energy and other raw materials in this module due to negligible values has been omitted.

C1 - dismantling, including disassembly or demolition of the product from the building, including initial sorting of materials on site - manual dismantling of the product at the end of its useful life is possible. The possible use of power tools for dismantling has a negligible impact on the impact category values. The energy consumption of this module is so small that it has been ignored.

C2 – it is assumed that pre-sorted waste is transported to a waste recovery or disposal facility, and partly to a landfill. Data is collected on the basis of a developed scenario.

C3 – considers the environmental impact during the treatment of construction and demolition waste containing plasterboard at a waste recovery facility. Data is collected on the basis of a developed scenario.

C4 – waste disposal, including physical pre-treatment and disposal site management, (environmental burdens). It was submitted that - 40% of the waste generated from plasterboard is landfilled.

D – depends on the impact and consequences of using secondary material. The calculations are based on a scenario developed.

Cut-off criteria	99% of all mass flows involved in the production process were taken into account. All the energy used in the process has been taken into account in the EPD.
General data	The main source of general and auxiliary data is the EcoInvent 3.8 database and manufacturer's reports.
Allocation	All data provided by the manufacturer have been referred to the declared unit (DU) of the product – 1 m^2 of gypsum plasterboards Knauf standard, impregnated, Akustik, fire resistant.

4. LCA: SCENARIOS AND ADDITIONAL TECHNICAL DATA

For the life cycle analysis of the products covered by the "Cradle to gate with options" environmental declaration, scenarios were developed for modules A4-A5, C1, C2, C3, C4 and D:

Module A4:

- Transport is carried out using 16-32 tonne trucks meeting EURO 6 emission standards,
- - Average distance from plant to customer 400 km.

Module A5:

The consumption of energy and other raw materials in this module has been omitted due to negligible values.

Module C1:

Demolition, including disassembly or dismantling of the product from the building, including initial sorting of materials on site - manual dismantling of the product at the end of its useful life is possible. The possible use of power tools for dismantling has a negligible impact on the impact category values. Energy consumption in this module is so small that it has been ignored.

Module C2:

The following assumptions were made to calculate the impact of this module:

- 60% of the waste mass is transported to a waste recovery facility where it is completely recycled, 40% of the waste is sent to a dedicated landfill.
- transport is carried out by means of dump trucks with a capacity of 7.5 - 16 tonnes, meeting EURO 6 emission standards,
- the material is transported to a waste treatment site located within 100 km of the demolition site.
- distance to dedicated landfill site 50 km adopted for calculations.

Module C3:

Captures the environmental impact during the treatment of construction and demolition waste containing plasterboard at a waste recovery facility. Data is collected based on a scenario developed. It is assumed that 60 % of the waste is recycled. The following processes were assumed for the calculations: unloading (loader), crushing (crusher).

The following were assumed for the calculations:

energy consumption 0.003 kWh/kg

fuel consumption 0.315 MJ/kg

* Data from the dedicated website: http://makrusz.com.pl/realizations/kruszarki/walcowe/kruszarka-do-recyclingu-pyt-kartonowo-gipsowych

Module C4:

Waste storage, including physical pre-treatment and disposal site management, (environmental loads). Compounded that - 40% of the waste generated from plasterboards is stored.

Module D:

Addresses the impact and effects of using recycled secondary material from waste containing plasterboard. At the end of its useful life, 60% of the waste is sent to a waste treatment facility. The product is subject to reuse, recovery, and recycling.

5. LCA: RESULTS

The table below shows the LCA modules included in the calculation of the environmental impact categories for the products covered by the declaration.

SYSTEM BOUNDARIES (X –MODULE INCLUDED IN LCA, MND – MODULE NOT DECLARED)																
Products stage			**Construction process stage**		**Use stage**							**End-of-life stage**				**Benefits and loads beyond the system boundary**
Raw material supply	Transport	Production	Transport	Construction process	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction	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**	**MND**	**MND**	**MND**	**MND**	**MND**	**X**	**X**	**X**	**X**	**X**

The following tables present the results of the LCA analysis for gypsum plasterboards.

Explanations of the abbreviations used to describe the impact categories are given below:

GWP-total	Global warming potential
GWP-fossil	Global warming potential fossil fuel

GWP-biogenic	Global warming potential biogenic
GWP-luluc	Global warming potential land use and land change
ODP	Depletion potential of the stratospheric ozone layer
AP	Acidification potential of land and water
EP-freshwater	Eutrophication potential, fraction of nutrients reaching freshwater end compartment.
EP-marine	Eutrophication potential, fraction of nutrients reaching marine end compartment.
EP-terrestrial	Eutrophication potential, Accumulated Exceedance
POCP	Formation potential of tropospheric ozone photochemical oxidants
ADP-minerals&metals	Abiotic depletion potential for non-fossil resources
ADP-fossil	Abiotic depletion potential for fossil resources
WDP	Water (user) deprivation potential
PM	Potential incidence of disease due to PM emissions
IRP	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 (non-cancerogenic)
SQP	Potential soil quality index
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
PEN-RE	Use of non-renewable primary energy resources excluding non-renewable primary energy resources used as raw materials.
RE	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 fuels
NRSF	Use of non-renewable secondary fuels
FW	Use of net fresh water

CORE ENVIRMONMENTAL IMPACT INDICATORS: 1 m² Knauf gypsum plasterboards standard											
	Life Cycle Stage										
Indicator	**Unit**	**A1**	**A2**	**A3**	**A4**	**A5**	**C1**	**C2**	**C3**	**C4**	**D**
GWP-total	kg CO_2 eq.	-9,64E-02	4,47E-03	2,02E+00	4,62E-01	1,27E-03	0,00E+00	2,30E-01	1,29E-01	1,17E-01	-8,57E-03
GWP-fossil	kg CO_2 eq.	1,69E-01	4,47E-03	2,02E+00	4,62E-01	1,27E-03	0,00E+00	2,30E-01	1,29E-01	1,17E-01	-8,51E-03
GWP-biogenic	kg CO_2 eq.	-2,73E-01	3,92E-06	-5,86E-03	3,99E-04	3,84E-06	0,00E+00	2,09E-04	9,01E-05	4,13E-05	-5,67E-05
GWP-luluc	kg CO_2 eq.	6,60E-03	1,98E-06	3,60E-04	1,85E-04	1,26E-07	0,00E+00	1,09E-04	1,45E-05	1,17E-05	-2,94E-06
ODP	kg CFC11 eq.	1,69E-08	1,02E-09	3,23E-07	1,07E-07	2,59E-10	0,00E+00	5,18E-08	2,52E-08	2,50E-08	-1,53E-09
AP	mol H+ eq.	1,12E-03	1,49E-05	8,64E-03	1,31E-03	1,29E-05	0,00E+00	6,51E-04	1,30E-03	1,22E-03	-2,12E-04
EP-freshwater	kg PO_4 eq.	3,70E-04	3,14E-07	6,74E-04	3,02E-05	5,81E-08	0,00E+00	1,73E-05	1,87E-05	3,62E-06	-6,85E-07
EP-marine	kg N eq.	4,15E-04	3,09E-06	1,25E-03	2,66E-04	5,58E-06	0,00E+00	1,27E-04	5,51E-04	5,38E-04	-7,45E-05
EP-terrestrial	mol N eq.	3,06E-03	3,38E-05	1,24E-02	2,90E-03	6,11E-05	0,00E+00	1,38E-03	6,01E-03	5,90E-03	-1,05E-03
POCP	kg NMVOC eq.	9,00E-04	1,22E-05	3,99E-03	1,12E-03	1,70E-05	0,00E+00	5,31E-04	1,65E-03	1,62E-03	-2,21E-04
ADP-minerals & metals	kg Sb eq.	1,20E-06	1,80E-08	2,09E-06	1,64E-06	6,51E-10	0,00E+00	1,05E-06	7,21E-08	6,02E-08	-4,21E-08
ADP-fossil	MJ	2,66E+00	6,73E-02	3,55E+01	7,00E+00	1,70E-02	0,00E+00	3,44E+00	1,74E+00	1,60E+00	-1,18E-01
WDP	WDP (m^3) world. eq. deprived	3,15E-01	2,14E-04	1,14E-01	2,13E-02	2,68E-05	0,00E+00	1,14E-02	4,17E-03	2,51E-03	-8,08E-04
ADDITIONAL ENVIRONMENTAL IMPACT INDICATORS: 1 m² Knauf gypsum plasterboards standard											
	Life Cycle Stage										
Indicator	**Unit**	**A1**	**A2**	**A3**	**A4**	**A5**	**C1**	**C2**	**C3**	**C4**	**D**
PM	Disease incidency	7,43E-09	3,35E-10	5,20E-08	3,72E-08	3,38E-10	0,00E+00	1,57E-08	3,27E-08	3,26E-08	-5,04E-09
IRP	kBq U235 eq.	3,36E-02	3,51E-04	9,56E-02	3,61E-02	7,54E-05	0,00E+00	1,83E-02	7,58E-03	7,23E-03	-1,20E-03
ETP-fw	CTUe	3,70E-04	3,14E-07	6,74E-04	3,02E-05	5,81E-08	0,00E+00	1,73E-05	1,87E-05	3,62E-06	-6,85E-07
HTP-c	CTUh	1,74E-10	1,87E-12	5,25E-10	1,77E-10	3,99E-13	0,00E+00	1,01E-10	4,02E-11	3,63E-11	-4,42E-12
HTP-nc	CTUh	3,24E-09	5,34E-11	1,26E-08	5,55E-09	1,12E-11	0,00E+00	2,72E-09	8,61E-10	6,81E-10	-1,05E-10
SQP	-	5,90E+01	4,35E-02	4,38E+00	4,88E+00	2,23E-03	0,00E+00	2,03E+00	2,29E-01	2,04E-01	9,91E-02
PARAMETERS DESCRIBING RESOURCE: 1 m² Knauf gypsum plasterboards standard											
	Life Cycle Stage										
Indicator	**Unit**	**A1**	**A2**	**A3**	**A4**	**A5**	**C1**	**C2**	**C3**	**C4**	**D**
PERE	MJ	1,06E+01	1,05E-03	1,12E+00	1,00E-01	1,06E-04	0,00E+00	5,83E-02	1,89E-02	8,02E-04	-1,29E-02
PERM	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT	MJ	1,06E+01	1,05E-03	1,12E+00	1,00E-01	1,06E-04	0,00E+00	5,83E-02	1,89E-02	8,02E-04	-1,29E-02
PEN-RE	MJ	2,47E+00	6,99E-02	3,91E+01	7,27E+00	1,80E-02	0,00E+00	3,57E+00	1,86E+00	1,37E-01	-1,14E-01
RE	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PENRT	MJ	2,47E+00	6,99E-02	3,91E+01	7,27E+00	1,80E-02	0,00E+00	3,57E+00	1,86E+00	1,37E-01	-1,14E-01
SM	kg	0,00E+00	0,00E+00	4,61E-03	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
RSF	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	4,75E-04
NRSF	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
FW	m^3	1,79E-01	8,56E-04	1,04E+00	1,03E-03	2,67E-06	0,00E+00	6,89E-04	9,89E-03	2,03E-05	-1,83E-04
ENVIRONMENTAL INFORMATION DESCRIBING WASTE AND OUTPUT FLOWS: 1 m² Knauf gypsum plasterboards standard											
	Life Cycle Stage										
Indicator	**Unit (expressed per DU)**	**A1**	**A2**	**A3**	**A4**	**A5**	**C1**	**C2**	**C3**	**C4**	**D**
Hazardous waste	kg	WN	WN	1,23E-04	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00

Non-hazardous waste	kg	WN	WN	4,66E-03	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Radioactive waste	kg	WN	WN	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Components for re-use	kg	WN	WN	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Materials for recycling	kg	WN	WN	4,61E-03	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Materials for energy recovery	kg	WN	WN	4,96E-04	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Exported energy	MJ/energy carrier	WN	WN	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	4,75E-04

CARBON ORGANIC	
Contents organic carbon in product (kg C_{org})	**1,27E-01**
Contents organic carbon in packaging (kg C_{org})	**1,58E-04**

CORE ENVIRMONMENTAL IMPACT INDICATORS: 1 m² Knauf gypsum plasterboard impregnated											
	Life Cycle Stage										
Indicator	**Unit**	**A1**	**A2**	**A3**	**A4**	**A5**	**C1**	**C2**	**C3**	**C4**	**D**
GWP-total	kg CO_2 eq.	-3,95E-02	4,47E-03	2,02E+00	4,94E-01	1,36E-03	0,00E+00	2,46E-01	1,38E-01	1,25E-01	-9,17E-03
GWP-fossil	kg CO_2 eq.	2,25E-01	4,47E-03	2,02E+00	4,94E-01	1,35E-03	0,00E+00	2,46E-01	1,38E-01	1,25E-01	-9,11E-03
GWP-biogenic	kg CO_2 eq.	-2,77E-01	3,92E-06	-5,86E-03	4,26E-04	4,11E-06	0,00E+00	2,24E-04	9,64E-05	4,42E-05	-6,07E-05
GWP-luluc	kg CO_2 eq.	1,16E-02	1,98E-06	3,60E-04	1,97E-04	1,35E-07	0,00E+00	1,16E-04	1,56E-05	1,25E-05	-3,15E-06
ODP	kg CFC11 eq.	3,97E-08	1,02E-09	3,23E-07	1,14E-07	2,77E-10	0,00E+00	5,54E-08	2,69E-08	2,67E-08	-1,64E-09
AP	mol H+ eq.	1,36E-03	1,49E-05	8,64E-03	1,40E-03	1,38E-05	0,00E+00	6,96E-04	1,39E-03	1,30E-03	-2,27E-04
EP-freshwater	kg PO_4 eq.	3,86E-04	3,14E-07	6,74E-04	3,24E-05	6,22E-08	0,00E+00	1,85E-05	2,00E-05	3,88E-06	-7,33E-07
EP-marine	kg N eq.	4,82E-04	3,09E-06	1,25E-03	2,85E-04	5,97E-06	0,00E+00	1,36E-04	5,89E-04	5,76E-04	-7,97E-05
EP-terrestrial	mol N eq.	3,43E-03	3,38E-05	1,24E-02	3,11E-03	6,54E-05	0,00E+00	1,48E-03	6,43E-03	6,31E-03	-1,13E-03
POCP	kg NMVOC eq.	1,03E-03	1,22E-05	3,99E-03	1,19E-03	1,82E-05	0,00E+00	5,68E-04	1,77E-03	1,74E-03	-2,37E-04
ADP-minerals & metals	kg Sb eq.	1,71E-06	1,80E-08	2,09E-06	1,75E-06	6,97E-10	0,00E+00	1,13E-06	7,71E-08	6,44E-08	-4,50E-08
ADP-fossil	MJ	3,60E+00	6,73E-02	3,55E+01	7,49E+00	1,82E-02	0,00E+00	3,68E+00	1,86E+00	1,72E+00	-1,27E-01
WDP	WDP (m^3) world. eq. deprived	3,97E-01	2,14E-04	1,14E-01	2,28E-02	2,87E-05	0,00E+00	1,22E-02	4,46E-03	2,69E-03	-8,64E-04
ADDITIONAL ENVIRONMENTAL IMPACT INDICATORS: 1 m² Knauf gypsum plasterboard impregnated											
	Life Cycle Stage										
Indicator	**Unit**	**A1**	**A2**	**A3**	**A4**	**A5**	**C1**	**C2**	**C3**	**C4**	**D**
PM	Disease incidency	9,29E-09	3,35E-10	5,20E-08	3,98E-08	3,62E-10	0,00E+00	1,68E-08	3,50E-08	3,48E-08	-5,39E-09
IRP	kBq U235 eq.	3,88E-02	3,51E-04	9,56E-02	3,86E-02	8,06E-05	0,00E+00	1,96E-02	8,11E-03	7,74E-03	-1,28E-03
ETP-fw	CTUe	3,86E-04	3,14E-07	6,74E-04	3,24E-05	6,22E-08	0,00E+00	1,85E-05	2,00E-05	3,88E-06	-7,33E-07

HTP-c	CTUh	2,28E-10	1,87E-12	5,25E-10	1,89E-10	4,27E-13	0,00E+00	1,08E-10	4,30E-11	3,89E-11	-4,73E-12
HTP-nc	CTUh	4,05E-09	5,34E-11	1,26E-08	5,94E-09	1,20E-11	0,00E+00	2,91E-09	9,21E-10	7,28E-10	-1,12E-10
SQP	-	5,95E+01	4,35E-02	4,38E+00	5,22E+00	2,38E-03	0,00E+00	2,18E+00	2,45E-01	2,19E-01	1,06E-01
PARAMETERS DESCRIBING RESOURCE: 1 m² Knauf gypsum plasterboard impregnated											
	Life Cycle Stage										
Indicator	**Unit**	**A1**	**A2**	**A3**	**A4**	**A5**	**C1**	**C2**	**C3**	**C4**	**D**
PERE	MJ	1,08E+01	1,05E-03	1,12E+00	1,07E-01	1,13E-04	0,00E+00	6,24E-02	2,02E-02	8,58E-04	-1,39E-02
PERM	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT	MJ	1,08E+01	1,05E-03	1,12E+00	1,07E-01	1,13E-04	0,00E+00	6,24E-02	2,02E-02	8,58E-04	-1,39E-02
PEN-RE	MJ	3,41E+00	6,99E-02	3,91E+01	7,78E+00	1,92E-02	0,00E+00	3,82E+00	1,99E+00	1,46E-01	-1,22E-02
RE	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PENRT	MJ	3,41E+00	6,99E-02	3,91E+01	7,78E+00	1,92E-02	0,00E+00	3,82E+00	1,99E+00	1,46E-01	-1,22E-02
SM	kg	0,00E+00	0,00E+00	4,61E-03	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
RSF	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	4,75E-04
NRSF	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
FW	m^3	2,28E-01	8,56E-04	1,04E+00	1,10E-03	2,86E-06	0,00E+00	7,37E-04	1,06E-02	2,17E-05	-1,96E-04
ENVIRONMENTAL INFORMATION DESCRIBING WASTE AND OUTPUT FLOWS: 1 m² Knauf gypsum plasterboard impregnated											
	Life Cycle Stage										
Indicator	**Unit (expressed per DU)**	**A1**	**A2**	**A3**	**A4**	**A5**	**C1**	**C2**	**C3**	**C4**	**D**
Hazardous waste	kg	WN	WN	1,23E-04	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Non-hazardous waste	kg	WN	WN	4,66E-03	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Radioactive waste	kg	WN	WN	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Components for re-use	kg	WN	WN	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Materials for recycling	kg	WN	WN	4,61E-03	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Materials for energy recovery	kg	WN	WN	4,96E-04	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Exported energy	MJ/energy carrier	WN	WN	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	4,75E-04

CARBON ORGANIC	
Contents organic carbon in product (kg C_{org})	**1,27E-01**
Contents organic carbon in packaging (kg C_{org})	**1,58E-04**

CORE ENVIRMONMENTAL IMPACT INDICATORS: 1 m² Knauf gypsum plasterboard Akustik											
	Life Cycle Stage										
Indicator	**Unit**	**A1**	**A2**	**A3**	**A4**	**A5**	**C1**	**C2**	**C3**	**C4**	**D**
GWP-total	kg CO_2 eq.	-7,58E-02	4,47E-03	2,02E+00	6,60E-01	1,81E-03	0,00E+00	3,28E-01	1,85E-01	1,67E-01	-1,22E-02
GWP-fossil	kg CO_2 eq.	2,02E-01	4,47E-03	2,02E+00	6,59E-01	1,81E-03	0,00E+00	3,28E-01	1,84E-01	1,67E-01	-1,22E-02
GWP-biogenic	kg CO_2 eq.	-2,83E-01	3,92E-06	-5,86E-03	5,69E-04	5,49E-06	0,00E+00	2,99E-04	1,29E-04	5,90E-05	-8,10E-05
GWP-luluc	kg CO_2 eq.	5,05E-03	1,98E-06	3,60E-04	2,64E-04	1,80E-07	0,00E+00	1,55E-04	2,08E-05	1,67E-05	-4,21E-06
ODP	kg CFC11 eq.	2,47E-08	1,02E-09	3,23E-07	1,53E-07	3,70E-10	0,00E+00	7,40E-08	3,59E-08	3,57E-08	-2,18E-09
AP	mol H+ eq.	1,19E-03	1,49E-05	8,64E-03	1,87E-03	1,84E-05	0,00E+00	9,29E-04	1,86E-03	1,74E-03	-3,03E-04
EP-freshwater	kg PO_4 eq.	3,88E-04	3,14E-07	6,74E-04	4,32E-05	8,30E-08	0,00E+00	2,48E-05	2,67E-05	5,18E-06	-9,78E-07
EP-marine	kg N eq.	4,01E-04	3,09E-06	1,25E-03	3,80E-04	7,97E-06	0,00E+00	1,81E-04	7,87E-04	7,69E-04	-1,06E-04
EP-terrestrial	mol N eq.	2,73E-03	3,38E-05	1,24E-02	4,15E-03	8,73E-05	0,00E+00	1,98E-03	8,58E-03	8,43E-03	-1,50E-03
POCP	kg NMVOC eq.	8,63E-04	1,22E-05	3,99E-03	1,59E-03	2,43E-05	0,00E+00	7,58E-04	2,36E-03	2,32E-03	-3,16E-04
ADP-minerals & metals	kg Sb eq.	1,62E-06	1,80E-08	2,09E-06	2,34E-06	9,30E-10	0,00E+00	1,50E-06	1,03E-07	8,59E-08	-6,01E-08
ADP-fossil	MJ	3,28E+00	6,73E-02	3,55E+01	9,99E+00	2,43E-02	0,00E+00	4,91E+00	2,48E+00	2,29E+00	-1,69E-01
WDP	WDP (m^3) world. eq. deprived	3,67E-01	2,14E-04	1,14E-01	3,04E-02	3,83E-05	0,00E+00	1,63E-02	5,95E-03	3,59E-03	-1,15E-03
ADDITIONAL ENVIRONMENTAL IMPACT INDICATORS: 1 m² Knauf gypsum plasterboard Akustik											
	Life Cycle Stage										
Indicator	**Unit**	**A1**	**A2**	**A3**	**A4**	**A5**	**C1**	**C2**	**C3**	**C4**	**D**
PM	Disease incidency	5,26E-09	3,35E-10	5,20E-08	5,31E-08	4,83E-10	0,00E+00	2,24E-08	4,67E-08	4,65E-08	-7,19E-09
IRP	kBq U235 eq.	3,76E-02	3,51E-04	9,56E-02	5,15E-02	1,08E-04	0,00E+00	2,61E-02	1,08E-02	1,03E-02	-1,71E-03
ETP-fw	CTUe	3,88E-04	3,14E-07	6,74E-04	4,32E-05	8,30E-08	0,00E+00	2,48E-05	2,67E-05	5,18E-06	-9,78E-07
HTP-c	CTUh	2,10E-10	1,87E-12	5,25E-10	2,52E-10	5,70E-13	0,00E+00	1,45E-10	5,74E-11	5,19E-11	-6,31E-12
HTP-nc	CTUh	4,46E-09	5,34E-11	1,26E-08	7,93E-09	1,60E-11	0,00E+00	3,88E-09	1,23E-09	9,72E-10	-1,50E-10
SQP	-	6,04E+01	4,35E-02	4,38E+00	6,97E+00	3,18E-03	0,00E+00	2,91E+00	3,27E-01	2,92E-01	1,42E-01
PARAMETERS DESCRIBING RESOURCE: 1 m² Knauf gypsum plasterboard Akustik											
	Life Cycle Stage										
Indicator	**Unit**	**A1**	**A2**	**A3**	**A4**	**A5**	**C1**	**C2**	**C3**	**C4**	**D**
PERE	MJ	1,09E+01	1,05E-03	8,66E-01	1,43E-01	1,51E-04	0,00E+00	8,33E-02	2,70E-02	1,15E-03	-1,85E-02
PERM	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT	MJ	1,09E+01	1,05E-03	8,66E-01	1,43E-01	1,51E-04	0,00E+00	8,33E-02	2,70E-02	1,15E-03	-1,85E-02
PEN-RE	MJ	3,08E+00	6,99E-02	3,91E+01	1,04E+01	2,57E-02	0,00E+00	5,10E+00	2,65E+00	1,95E-01	-1,64E-02
RE	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PENRT	MJ	3,08E+00	6,99E-02	3,91E+01	1,04E+01	2,57E-02	0,00E+00	5,10E+00	2,65E+00	1,95E-01	-1,64E-02
SM	kg	0,00E+00	0,00E+00	4,61E-03	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
RSF	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	4,75E-04
NRSF	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
FW	m^3	2,05E-01	8,56E-04	1,04E+00	1,47E-03	3,82E-06	0,00E+00	9,84E-04	1,41E-02	2,90E-05	-2,62E-04
ENVIRONMENTAL INFORMATION DESCRIBING WASTE AND OUTPUT FLOWS: 1 m² Knauf gypsum plasterboard Akustik											
	Life Cycle Stage										
Indicator	**Unit (expressed per DU)**	**A1**	**A2**	**A3**	**A4**	**A5**	**C1**	**C2**	**C3**	**C4**	**D**
Hazardous waste	kg	WN	WN	1,23E-04	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00

Non-hazardous waste	kg	WN	WN	4,66E-03	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Radioactive waste	kg	WN	WN	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Components for re-use	kg	WN	WN	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Materials for recycling	kg	WN	WN	4,61E-03	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Materials for energy recovery	kg	WN	WN	4,96E-04	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Exported energy	MJ/energy carrier	WN	WN	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	4,75E-04

CARBON ORGANIC	
Contents organic carbon in product (kg C_{org})	**1,31E-01**
Contents organic carbon in packaging (kg C_{org})	**1,58E-04**

CORE ENVIRMONMENTAL IMPACT INDICATORS: 1 m² Knauf gypsum plasterboard fire resistant											
	Life Cycle Stage										
Indicator	**Unit**	**A1**	**A2**	**A3**	**A4**	**A5**	**C1**	**C2**	**C3**	**C4**	**D**
GWP-total	kg CO_2 eq.	8,82E-02	4,47E-03	2,02E+00	6,97E-01	1,92E-03	0,00E+00	3,47E-01	1,95E-01	1,77E-01	-1,29E-02
GWP-fossil	kg CO_2 eq.	3,58E-01	4,47E-03	2,02E+00	6,96E-01	1,91E-03	0,00E+00	3,47E-01	1,95E-01	1,77E-01	-1,28E-02
GWP-biogenic	kg CO_2 eq.	-2,75E-01	3,92E-06	-6,18E-03	6,01E-04	5,80E-06	0,00E+00	3,16E-04	1,36E-04	6,23E-05	-8,56E-05
GWP-luluc	kg CO_2 eq.	4,76E-03	1,98E-06	3,62E-04	2,79E-04	1,90E-07	0,00E+00	1,64E-04	2,19E-05	1,76E-05	-4,44E-06
ODP	kg CFC11 eq.	3,52E-08	1,02E-09	3,23E-07	1,61E-07	3,91E-10	0,00E+00	7,82E-08	3,80E-08	3,77E-08	-2,31E-09
AP	mol H+ eq.	2,52E-03	1,49E-05	8,64E-03	1,98E-03	1,94E-05	0,00E+00	9,82E-04	1,97E-03	1,83E-03	-3,20E-04
EP-freshwater	kg PO_4 eq.	4,39E-04	3,14E-07	6,75E-04	4,56E-05	8,77E-08	0,00E+00	2,62E-05	2,82E-05	5,47E-06	-1,03E-06
EP-marine	kg N eq.	6,95E-04	3,09E-06	1,25E-03	4,02E-04	8,42E-06	0,00E+00	1,92E-04	8,31E-04	8,13E-04	-1,12E-04
EP-terrestrial	mol N eq.	6,15E-03	3,38E-05	1,24E-02	4,38E-03	9,22E-05	0,00E+00	2,09E-03	9,06E-03	8,90E-03	-1,59E-03
POCP	kg NMVOC eq.	1,77E-03	1,22E-05	4,00E-03	1,68E-03	2,56E-05	0,00E+00	8,01E-04	2,49E-03	2,45E-03	-3,34E-04
ADP-minerals & metals	kg Sb eq.	4,05E-06	1,80E-08	2,10E-06	2,47E-06	9,83E-10	0,00E+00	1,59E-06	1,09E-07	9,08E-08	-6,35E-08
ADP-fossil	MJ	5,92E+00	6,73E-02	3,55E+01	1,06E+01	2,57E-02	0,00E+00	5,19E+00	2,62E+00	2,42E+00	-1,79E-01
WDP	WDP (m^3) world. eq. deprived	4,79E-01	2,14E-04	1,15E-01	3,21E-02	4,05E-05	0,00E+00	1,72E-02	6,29E-03	3,79E-03	-1,22E-03
ADDITIONAL ENVIRONMENTAL IMPACT INDICATORS: 1 m² Knauf gypsum plasterboard fire resistant											
	Life Cycle Stage										
Indicator	**Unit**	**A1**	**A2**	**A3**	**A4**	**A5**	**C1**	**C2**	**C3**	**C4**	**D**
PM	Disease incidency	1,99E-08	3,35E-10	5,20E-08	5,61E-08	5,11E-10	0,00E+00	2,37E-08	4,94E-08	4,92E-08	-7,60E-09
IRP	kBq U235 eq.	6,55E-02	3,51E-04	9,57E-02	5,44E-02	1,14E-04	0,00E+00	2,76E-02	1,14E-02	1,09E-02	-1,81E-03
ETP-fw	CTUe	4,39E-04	3,14E-07	6,75E-04	4,56E-05	8,77E-08	0,00E+00	2,62E-05	2,82E-05	5,47E-06	-1,03E-06

HTP-c	CTUh	3,79E-10	1,87E-12	5,26E-10	2,67E-10	6,02E-13	0,00E+00	1,53E-10	6,07E-11	5,48E-11	-6,67E-12
HTP-nc	CTUh	1,39E-08	5,34E-11	1,26E-08	8,38E-09	1,69E-11	0,00E+00	4,10E-09	1,30E-09	1,03E-09	-1,58E-10
SQP	-	6,00E+01	4,35E-02	4,41E+00	7,36E+00	3,36E-03	0,00E+00	3,07E+00	3,46E-01	3,08E-01	1,50E-01
PARAMETERS DESCRIBING RESOURCE: 1 m² Knauf gypsum plasterboard fire resistant											
	Life Cycle Stage										
Indicator	**Unit**	**A1**	**A2**	**A3**	**A4**	**A5**	**C1**	**C2**	**C3**	**C4**	**D**
PERE	MJ	1,10E+01	1,05E-03	1,13E+00	1,51E-01	1,15E-04	0,00E+00	8,80E-02	2,85E-02	1,21E-03	-1,95E-02
PERM	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT	MJ	1,10E+01	1,05E-03	1,13E+00	1,51E-01	1,15E-04	0,00E+00	8,80E-02	2,85E-02	1,21E-03	-1,95E-02
PEN-RE	MJ	5,51E+00	6,99E-02	3,91E+01	1,10E+01	2,71E-02	0,00E+00	5,39E+00	2,80E+00	2,06E-01	-1,73E-01
RE	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PENRT	MJ	5,51E+00	6,99E-02	3,91E+01	1,10E+01	2,71E-02	0,00E+00	5,39E+00	2,80E+00	2,06E-01	-1,73E-01
SM	kg	0,00E+00	0,00E+00	4,62E-03	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
RSF	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	4,89E-04
NRSF	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
FW	m^3	2,54E-01	8,56E-04	1,04E+00	1,55E-03	4,04E-06	0,00E+00	1,04E-03	1,49E-02	3,07E-05	-2,77E-04
ENVIRONMENTAL INFORMATION DESCRIBING WASTE AND OUTPUT FLOWS: 1 m² Knauf gypsum plasterboard fire resistant											
	Life Cycle Stage										
Indicator	**Unit (expressed per DU)**	**A1**	**A2**	**A3**	**A4**	**A5**	**C1**	**C2**	**C3**	**C4**	**D**
Hazardous waste	kg	WN	WN	1,23E-04	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Non-hazardous waste	kg	WN	WN	4,66E-03	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Radioactive waste	kg	WN	WN	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Components for re-use	kg	WN	WN	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Materials for recycling	kg	WN	WN	4,62E-03	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Materials for energy recovery	kg	WN	WN	4,97E-04	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Exported energy	MJ/energy carrier	WN	WN	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	4,89E-04

CARBON ORGANIC	
Contents organic carbon in product (kg C_{org})	**1,29E-01**
Contents organic carbon in packaging (kg C_{org})	**1,63E-04**

4. INTERPRETATION OF LCA

Figures 2, 3, 4 and 5 show contributions of the each life cycl module to the basic impact categories for gypsum plasterboards – *Knauf gypsum plasterboards standard, Knauf gypsum plasterboards impregnated, Knauf gypsum plasterboards Akustik, Knauf gypsum plasterboards fire resistant:*

Fig. 2 Shares of life cycle modules on main categories of influence - Knauf gypsum plasterboards standard:

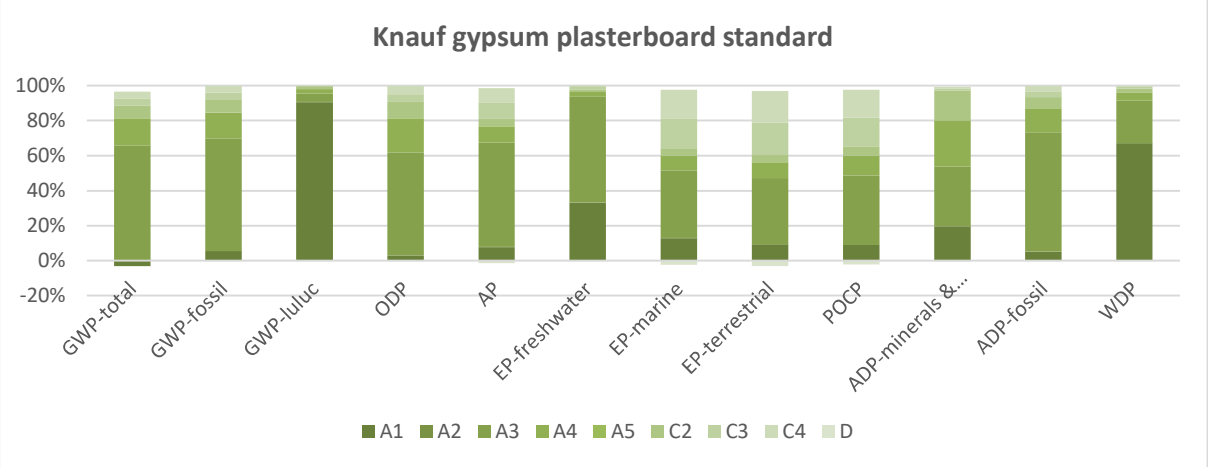


Fig. 3 Shares of life cycle modules on main categories of influence - Knauf gypsum plasterboards impregnated:

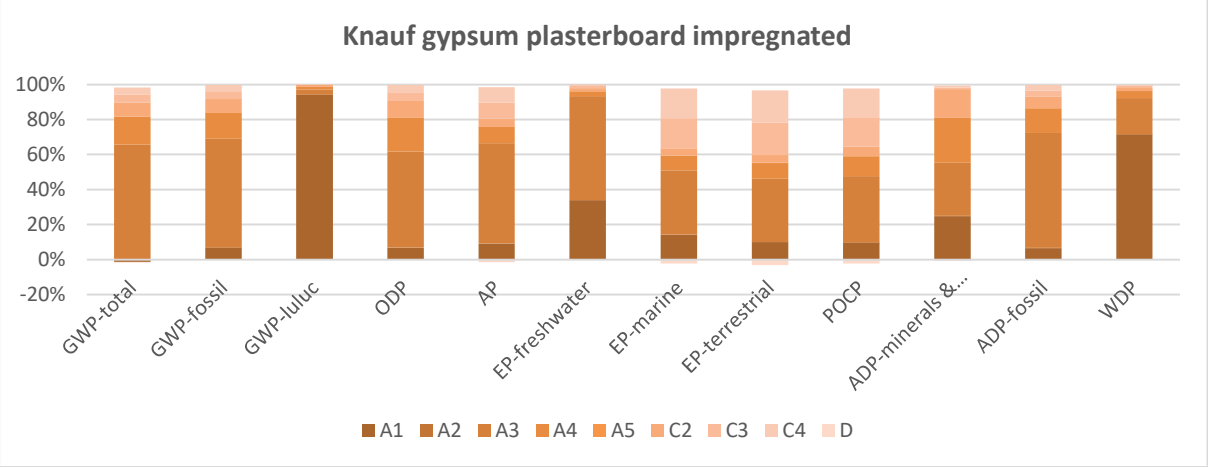


Fig. 4 Shares of life cycle modules on main categories of influence - Knauf gypsum plasterboards Akustik:

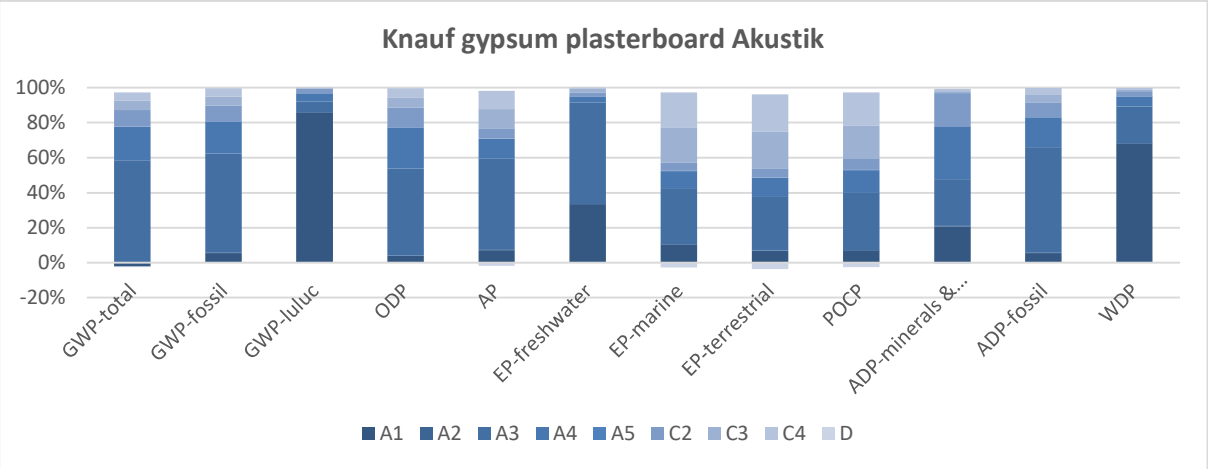
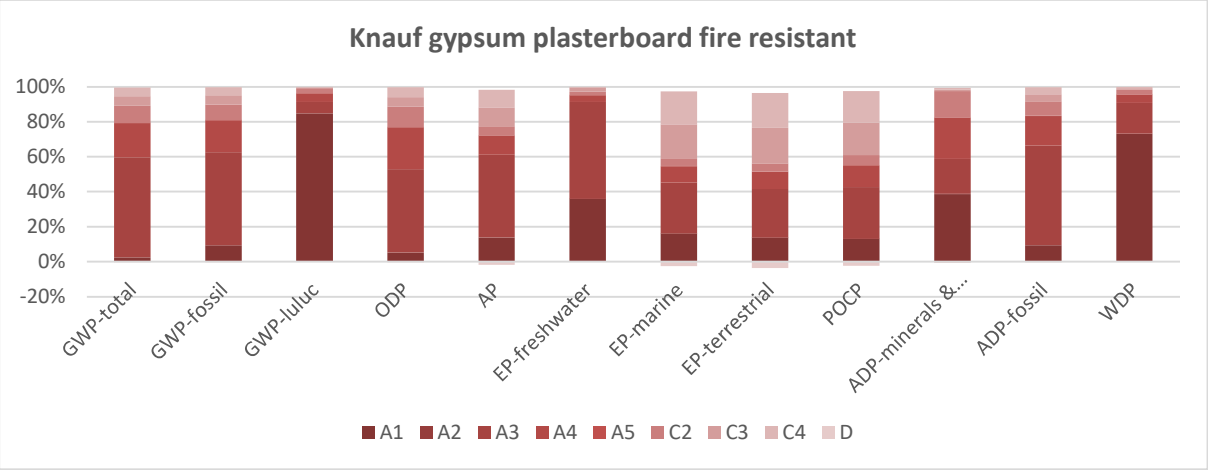


Fig. 5 Shares of life cycle modules on main categories of influence - Knauf gypsum plasterboards fire resistant:



- The production processes of all plasterboards use the same technology and production facilities. Comparing the results for the production stage - product phase modules A1-A3, it can be concluded that the lowest environmental impact is observed for ordinary gypsum boards, which account for about 60% of the boards produced. The results for the other types of plasterboard are higher depending on their composition and the additives used.
- The LCA analysis proved that the processes involved in plasterboard production have the greatest impact on the value of the environmental impact indicators (A3).

- In contrast, the impact of transport to the plant (A2), for example, in the category 'climate change' for all plasterboard produced, represents between approx. 0.1 and approx. 0.2% of the total impact in the main categories. Such small percentages are due to the fact that the transport of raw materials mainly takes place by conveyor belt systems.
- Module A3-production in the "climate change" category for all plasterboard produced ranges from 60 to almost 75 % of the value of all impact categories.
- The environmental impact of modules C1-C4 is relatively low.
- Given the above conclusions, the owner of the declaration does not have much influence on the values of the environmental impact indicators.

LITERATURE

- ✓ PN-EN ISO 14025:2014-04, Environmental labels and declarations – Type III environmental declarations – Rules and procedures.
- ✓ PN-EN 15804+A2:2020, Sustainability of construction works – Environmental product declarations – Basic rules for categorizing construction products.
- ✓ PN-EN ISO 14040:2009 Environmental management. Life Cycle Assessment. Principles and structure.
- ✓ PN-EN ISO 14044:2009, Environmental management. Life Cycle Assessment. Requirements and guidelines.
- ✓ EN 15942:2012, Sustainability of construction works – Environmental product declarations – Communication format business-to-business.
- ✓ http://makrusz.com.pl/realizations/kruszarki/walcowe/kruszarka-do-recyclingu-pyt-kartonowo-gipsowych.
- ✓ Declarations of Performance
- ✓ Data from company website: www.knauf.pl

Explanatory materials can be found on the manufacturer’s website: www.knauf.pl

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PROCESS ENGINEERING RESEARCH GROUP

TYPE III ENVIRONMENTAL DECLARATION CERTIFICATE

no. 03-12/2023

Products:

Gypsum plasterboards

Owner:

Knauf

25 Światowa Str.
02-229 Warszawa

The declaration was developed in accordance with the requirements of the standard:

PN-EN 15804+A2: 2020-03

Sustainability of construction works
Environmental product declarations
Core rules for the product category of construction products

The declaration was verified in accordance with the requirements of the standard:

PN-EN ISO 14025:2010

Environmental labels and declarations
Type III environmental declarations. Principles and procedures

The certificate was issued for the first time on **December,11 2023** and is valid for 5 years or until the said EPD is amended.

Process Engineering Research Group Leader

Ewa Głodek-Bucyk, PhD Eng.

INSTYTUT BADAWCZY ŁUKASIEWICZ CERAMIKI I MATERIAŁÓW BUDOWLANYCH

Director of Center Of Environmental Engineering

Joanna Poluszyńska, PhD

Opole, December 2023