ENVIRONMENTAL PRODUCT DECLARATION

Nr 01-09/2023

Powder Mass

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:	*04.09.2023*
Valid until:	*04.09.2028*

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ENVIRONMENTAL PRODUCT DECLARATION
No 01-09/2023

KNAUF

Owner of the EPD: Knauf sp. z o.o.	**Products covered by the EPD:** Powder mass
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 str 02-229 Warszawa Telephone: +48 22 36 95 100 e-mail: biuro@knauf.pl **https://www.knauf.pl/**
Date of issuance: 04.09.2023	**Declared product/declared unit:** The declared unit (DU) for the products is 1 kg (1 kilogram) – KNAUF G-K START, KNAUF G-K FINISH, KNAUF MP FINISH
EPD valid until: 04.09.2028	**Scope:** The declaration covers the following products: **KNAUF** G-K START, KNAUF G-K FINISH, KNAUF MP FINISH produced in the Knauf Jaworzno III sp. z o.o.; 51 Promienna str, 43-603 Jaworzno. 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 powder mass – KNAUF G-K START, KNAUF G-K FINISH, KNAUF MP FINISH produced by Knauf Jaworzno III sp. z o.o. 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.

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KNAUF

Representativeness:	Polish product, year 2022
Reference Service Life (RSL):	50 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 powder mass 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. MANUFACTURER AND PRODUCT DESCRIPTION

Knauf sp. z o. o. is the world's leading company of modern building materials. In Poland, Knauf brand products have been available for 25 years, becoming a leader in building materials. The product range includes drywall systems based on gypsum cardboard, gypsum and cement-lime plasters, joint compounds, smoothing, screeds and construction chemicals. G-K START and G-K FINISH are complex gypsum-based mass that provide the right finish for joints, as well as plasterboard building systems. MP FINISH is a gypsum powder mass for the final finishing of mineral surfaces.

Caring for the environment is one of the company's most important foundations. The company is ISO 14001, 9001 and GRCA certified. The quality of the products is confirmed by tests in accredited laboratories.

The company focuses on innovation, constantly looking for new ways of development and developing products in such a way that they best meet the needs of their users.

The group of products covered by the declaration are powder mass:

- Knauf G-K START, Knauf G-K FINISH, Knauf MP FINISH

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

Material	Mass fraction [%]
Gypsum	50-70
Dolomite powder	30-50
Calcium hydroxide	~1
Retarding additives	0,3-0,5
Cellulose thickeners	0,2-0,4
Additives	~0,6

The production process begins by receiving gypsum directly from the power station or from an external storage site, which then goes into a silo in front of the kiln. The gypsum is roasted in the kiln, and after the roasting process it is transported to the screen. There, after sieving, it goes to the mixing and packaging line No.2. The sieved gypsum, together with the large components, is weighed. Additives (small components) are weighed. All the components according to the recipe go to the mixer, where an even mixing process takes place. The finished bulk mixture is directed to the equipment that packs the material into bags. Once bagged, the material is placed on pallets and stored in the warehouse, where it awaits loading and transport to the end customer.

The technological of the production process of powder mass is shown below:

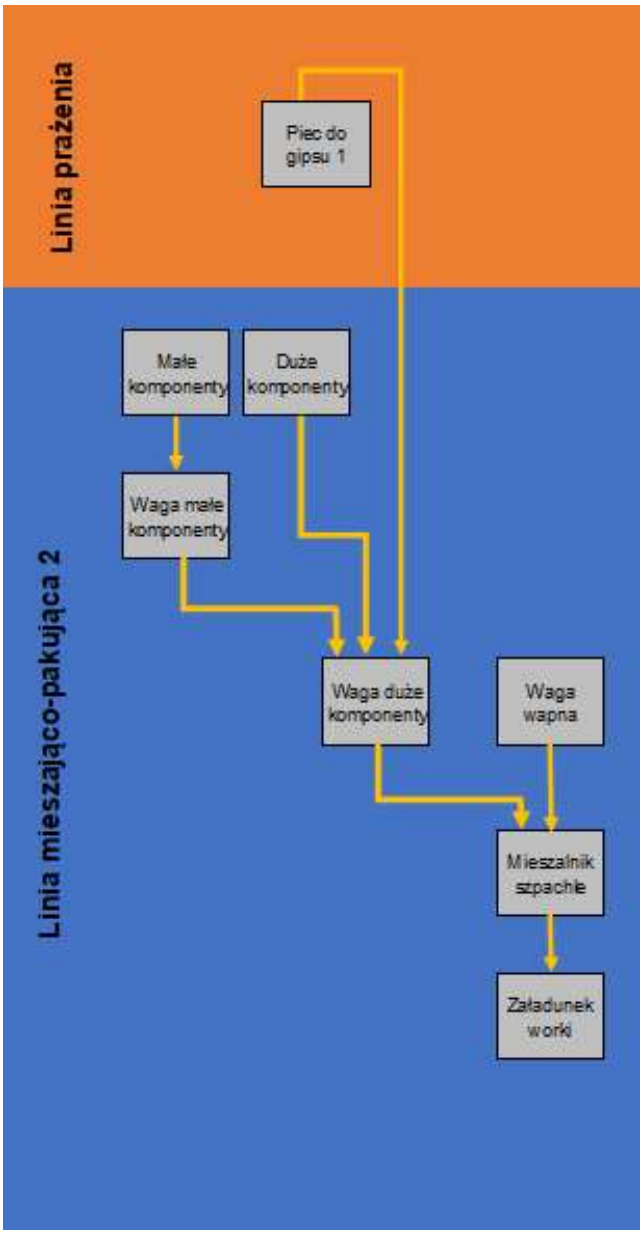

Fig. 1: The production diagram of powder mass by Knauf sp. z o.o.

Knauf G-K Start is a gypsum powder mass designed for grouting plasterboard joints, for filling and repairing defects, and for installing corner profiles and electrical boxes. It is designed for manual application, also on mineral surfaces indoors, such as gypsum plaster, cement-lime plaster, old plaster, and as a starting layer preceding further finishing work.

Product properties	
Reaction on fire	A1
Consumption	0,3 kg/m^2
Layer Thickness	max. 10 mm
pH	6,5-7,5

Knauf G-K Finish is a powdered mass based on gypsum and special additives for the final finishing of the surface of all types of gypsum boards in the Q3 and Q4 standard. The mass should be applied by hand, it can also be used on mineral surfaces such as gypsum plaster, cement-lime plaster and resin plaster after their prior preparation.

Product properties	
Reaction on fire	A1
Consumption	1 kg/m^2
Layer Thickness	max. 3 mm
pH	10-12

Knauf MP Finish is a powdered gypsum-based mass compound and selected additives for finishing mineral surfaces indoors, such as gypsum plaster, cement-lime plaster, old plaster, concrete surfaces and gypsum plasterboard in Q4 standard. The mass can be applied manually as well as by machine using special aggregates.

Product properties	
Reaction on fire	A1
Consumption	1 kg/m^2
Layer Thickness	max. 5 mm
pH	10-12

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 raw materials to the gate of the production plant,
- A3 – production, including ancillary processes and emissions,
- A4 – transport to the building site,
- A5 – installation into the building,
- C1 – deconstruction/demolition,
- C2 – transport to the waste processing facility,
- C3 – processing of waste material,

- C4 – treatment of waste material,
- 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 negligible differences between the two groups of products, the declared unit of 1 kg powder mass – KNAUF G-K START, KNAUF G-K FINISH and KNAUF MP FINISH produced in Knauf Jaworzno III sp. z o.o.

Assumptions

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

A2 – distances from the place of obtaining raw materials to the production plant individual for each raw material, means of transport differentiated due to the method of raw materials delivery.

A3 – values of CO_2, NO_x, SO_2, dust and other emissions from the production process obtained as a result of measurements carried out at the plant, other estimated on the basis of fuel consumption.

A4 - the transportation of materials to the construction site is carried out according to a developed scenario. It assumes the method of transportation and the distance over which materials are transported.

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

C1 - demolition/demolition of masonry walls is considered part of the process of demolition of the entire building. Powder mass as a wall covering is a small

percentage of the masonry wall mass. Therefore, the contribution of powder masses to the demolition of the entire building can be ignored and the impact of this module can be assumed to be zero.

C2 – it is assumed that pre-sorted demolition waste containing powdered mass is always transported to a recovery plant (recycling plant). Data is collected based on the developed scenario.

C3 – considers the environmental impact during the processing of construction and demolition waste containing powdered masses at a waste recovery facility. Data is collected based on the developed scenario.

C4 – should take into account the impact of landfilled construction debris containing powdered masses. In the developed scenario, landfilling operations are not considered, as construction rubble is not a worthless waste, is recyclable and should not be sent to municipal landfills.

D – addresses the impact and effects of using recycled recycled construction debris material containing powder mass. There is a lot of uncertainty regarding the development of scenarios for the D module, which makes modeling and calculations difficult. The recycled 0/63 mm aggregate fraction of construction rubble 17 01 01, which contains powder masses, contributes to saving natural resources. However, their low share m in the total fraction makes the positive impacts resulting from the reuse of the declared material insignificant. When processed rubble with code 17 01 02 containing the analyzed product is used to fill pits, this also contributes to saving natural resources.

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 considered 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 kg of powder mass produced by company Knauf sp. z o.o. in Jaworzno III.

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-C4 and D:

Module A4:

- Transportation is carried out using trucks with a load capacity of 3.5-7.5 tons, meeting EURO 6 emission standards,
- The average distance from the company to the customer 100 km.

Module A5:

Consumption of energy and other raw materials in this module due to negligible values has been ignored.

Module C1:

Demolition/demolition of walls is considered part of the process of demolishing the entire building. Powder mass as a wall covering is a small percentage of the masonry wall mass. Therefore, the contribution of powder masses to the demolition of the entire building can be ignored and the impact of this module can be assumed to be zero.

Module C2:

In order to calculate the impact of this module, the following assumptions were made:

• 100% waste is transported to a recovery plant as part of waste 17 01 01 or 17 01 02 (construction rubble),

• Transport is carried out using self-unloading trucks with a load capacity 7.5 - 16 tons, meeting EURO 6 emission standards

• The materials are transported to a waste treatment site 100 km from the demolition site.

Module C3:

Waste containing powder mass intended for recovery is classified as "non-hazardous waste" with code 17 01 01 or 17 01 02. The recycling process includes crushing and screening. There is no pre-treatment, additional fraction screening or post treatment. Recycling takes place at the waste treatment plant. Only coarse crushing is used to obtain the appropriate classification. Group of waste (17 01 02) is usually recovered during backfilling. Electricity consumption per 1 kg of waste is 0.03 kWh/kg, and energy for internal transport vehicles is 0.3 MJ.

Module D:

Module D - There is a great deal of uncertainty in the development of scenarios for Module D, that makes modeling and calculations difficult. The recycled 0/63 mm aggregate fraction of construction debris 17 01 01, which contains powdered masses, contributes to the savings of natural resources. However, their low share m in the total fraction makes the positive impacts resulting from the reuse of the declared material insignificant. When processed rubble with code 17 01 02 containing the analyzed product is used to fill pits, this also contributes to saving natural resources.

4. 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 powder mass. 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-terrestial	Eutrophication potential, Accumulated Exceedance
POCP	Formation potential of tropospheric ozone photochemical oxidants
ADP-minerals&metals	Abiotic depletion potential for nonfossil 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

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CORE ENVIRMONMENTAL IMPACT INDICATORS: 1 kg Knauf G-K Start											
	Life Cycle Stage										
Indicator	**Unit**	**A1**	**A2**	**A3**	**A4**	**A5**	**C1**	**C2**	**C3**	**C4**	**D**
GWP-total	kg CO_2 eq.	2,99E-02	5,30E-02	4,29E-02	7,00E-06	0,00E+00	0,00E+00	2,24E-02	5,93E-02	0,00E+00	-3,58E-03
GWP-fossil	kg CO_2 eq.	2,98E-02	5,29E-02	4,27E-02	6,98E-06	0,00E+00	0,00E+00	2,23E-02	5,91E-02	0,00E+00	-3,57E-03
GWP-biogenic	kg CO_2 eq.	-2,67E-05	4,59E-05	1,70E-04	7,10E-09	0,00E+00	0,00E+00	1,14E-05	1,31E-04	0,00E+00	-1,08E-05
GWP-luluc	kg CO_2 eq.	5,23E-05	2,27E-05	1,04E-05	4,17E-09	0,00E+00	0,00E+00	1,11E-05	9,98E-06	0,00E+00	-3,55E-07
ODP	kg CFC11 eq.	1,06E-09	1,22E-08	5,51E-09	1,53E-12	0,00E+00	0,00E+00	4,65E-09	6,58E-09	0,00E+00	-7,32E-10
AP	mol H+ eq.	1,43E-04	1,96E-04	3,25E-04	2,01E-08	0,00E+00	0,00E+00	6,60E-05	5,19E-04	0,00E+00	-3,63E-05
EP-freshwater	kg PO_4 eq.	2,20E-05	3,62E-06	5,07E-05	6,49E-10	0,00E+00	0,00E+00	1,89E-06	3,82E-05	0,00E+00	-1,64E-07
EP-marine	kg N eq.	1,89E-05	4,72E-05	4,55E-05	3,72E-09	0,00E+00	0,00E+00	1,30E-05	1,64E-04	0,00E+00	-1,57E-05
EP-terrestrial	mol N eq.	1,58E-04	5,16E-04	4,00E-04	4,04E-08	0,00E+00	0,00E+00	1,41E-04	1,73E-03	0,00E+00	-1,72E-04
POCP	kg NMVOC eq.	5,92E-05	1,73E-04	1,19E-04	1,56E-08	0,00E+00	0,00E+00	5,26E-05	4,76E-04	0,00E+00	-4,79E-05
ADP-minerals & metals	kg Sb eq.	3,33E-07	2,03E-07	1,32E-07	4,34E-11	0,00E+00	0,00E+00	9,91E-08	4,44E-08	0,00E+00	-1,84E-09
ADP-fossil	MJ	7,90E-01	7,99E-01	7,42E-01	1,04E-04	0,00E+00	0,00E+00	3,24E-01	7,27E-01	0,00E+00	-4,80E-02
WDP	WDP (m^3) świat. ekw	1,38E-02	2,50E-03	5,57E-03	4,03E-07	0,00E+00	0,00E+00	1,23E-03	4,72E-03	0,00E+00	-7,57E-05
ADDITIONAL ENVIRONMENTAL IMPACT INDICATORS: 1 kg Knauf G-K Start											
	Life Cycle Stage										
Indicator	**Unit**	**A1**	**A2**	**A3**	**A4**	**A5**	**C1**	**C2**	**C3**	**C4**	**D**
PM	Disease incidency	1,25E-08	4,24E-09	5,85E-10	4,03E-13	0,00E+00	0,00E+00	1,52E-09	8,40E-09	0,00E+00	-9,55E-10
IRP	kBq U235 eq.	1,20E-02	4,15E-03	2,48E-03	5,80E-07	0,00E+00	0,00E+00	1,49E-03	2,65E-03	0,00E+00	-2,13E-04
ETP-fw	CTUe	2,20E-05	3,62E-06	5,07E-05	6,49E-10	0,00E+00	0,00E+00	1,89E-06	3,82E-05	0,00E+00	-1,64E-07
HTP-c	CTUh	1,60E-11	2,26E-11	1,57E-11	3,80E-15	0,00E+00	0,00E+00	9,63E-12	1,87E-11	0,00E+00	-1,13E-12
HTP-nc	CTUh	3,83E-10	6,48E-10	6,78E-10	8,65E-14	0,00E+00	0,00E+00	2,62E-10	6,15E-10	0,00E+00	-3,17E-11
SQP	-	1,42E-01	5,30E-01	1,20E-01	5,07E-05	0,00E+00	0,00E+00	1,89E-01	1,12E-01	0,00E+00	-6,29E-03
PARAMETERS DESCRIBING RESOURCE: 1 kg Knauf G-K Start											
	Life Cycle Stage										
Indicator	**Unit**	**A1**	**A2**	**A3**	**A4**	**A5**	**C1**	**C2**	**C3**	**C4**	**D**
PERE	MJ	1,06E-01	1,20E-02	3,40E-02	2,21E-06	0,00E+00	0,00E+00	4,36E-03	2,66E-02	0,00E+00	-2,98E-04
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	1,20E-02	3,40E-02	2,21E-06	0,00E+00	0,00E+00	4,36E-03	2,66E-02	0,00E+00	-2,98E-04
PEN-RE	MJ	6,60E-01	8,31E-01	8,94E-01	1,08E-04	0,00E+00	0,00E+00	3,44E-01	8,49E-01	0,00E+00	-5,07E-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	6,60E-01	8,31E-01	8,94E-01	1,08E-04	0,00E+00	0,00E+00	3,44E-01	8,49E-01	0,00E+00	-5,07E-02
SM	kg	0,00E+00	0,00E+00	1,78E-05	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,00E+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	8,19E-06
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	2,22E-03	1,36E-04	3,27E-02	2,56E-08	0,00E+00	0,00E+00	1,19E-05	2,43E-02	0,00E+00	-7,53E-06
ENVIRONMENTAL INFORMATION DESCRIBING WASTE AND OUTPUT FLOWS: 1 kg Knauf G-K Start											
	Life Cycle Stage										
Indicator	**Unit (expressed per DU)**	**A1**	**A2**	**A3**	**A4**	**A5**	**C1**	**C2**	**C3**	**C4**	**D**
Hazardous waste	kg	WN	WN	1,61E-05	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	1,39E-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	1,78E-05	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,00E+00	0,00E+00	0,00E+00
Materials for energy recovery	kg	WN	WN	1,71E-05	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	8,19E-06

CARBON ORGANIC	
Contents organic carbon in product (kg C_{org})	**1,09E-03**
Contents organic carbon in packaging (kg C_{org})	**9,20E-06**

CORE ENVIRMONMENTAL IMPACT INDICATORS: 1 kg Knauf G-K Finish											
	Life Cycle Stage										
Indicator	**Unit**	**A1**	**A2**	**A3**	**A4**	**A5**	**C1**	**C2**	**C3**	**C4**	**D**
GWP-total	kg CO_2 eq.	4,18E-02	5,19E-02	4,33E-02	1,97E-04	0,00E+00	0,00E+00	2,21E-02	5,93E-02	0,00E+00	-3,58E-03
GWP-fossil	kg CO_2 eq.	4,12E-02	5,18E-02	4,31E-02	1,97E-04	0,00E+00	0,00E+00	2,21E-02	5,91E-02	0,00E+00	-3,57E-03
GWP-biogenic	kg CO_2 eq.	4,66E-04	4,47E-05	1,72E-04	2,00E-07	0,00E+00	0,00E+00	1,13E-05	1,31E-04	0,00E+00	-1,08E-05
GWP-luluc	kg CO_2 eq.	4,59E-05	2,25E-05	1,05E-05	1,17E-07	0,00E+00	0,00E+00	1,09E-05	9,98E-06	0,00E+00	-3,55E-07
ODP	kg CFC11 eq.	2,24E-09	1,19E-08	6,32E-09	4,29E-11	0,00E+00	0,00E+00	4,60E-09	6,58E-09	0,00E+00	-7,32E-10
AP	mol H+ eq.	1,58E-04	2,03E-04	3,29E-04	5,66E-07	0,00E+00	0,00E+00	6,53E-05	5,19E-04	0,00E+00	-3,63E-05
EP-freshwater	kg PO_4 eq.	1,94E-05	3,55E-06	5,08E-05	1,83E-08	0,00E+00	0,00E+00	1,87E-06	3,82E-05	0,00E+00	-1,64E-07
EP-marine	kg N eq.	2,43E-05	4,98E-05	4,62E-05	1,05E-07	0,00E+00	0,00E+00	1,28E-05	1,64E-04	0,00E+00	-1,57E-05
EP-terrestrial	mol N eq.	1,75E-04	5,46E-04	4,07E-04	1,14E-06	0,00E+00	0,00E+00	1,40E-04	1,73E-03	0,00E+00	-1,72E-04
POCP	kg NMVOC eq.	7,08E-05	1,79E-04	1,21E-04	4,40E-07	0,00E+00	0,00E+00	5,20E-05	4,76E-04	0,00E+00	-4,79E-05
ADP-minerals & metals	kg Sb eq.	3,57E-07	2,00E-07	1,32E-07	1,22E-09	0,00E+00	0,00E+00	9,81E-08	4,44E-08	0,00E+00	-1,84E-09
ADP-fossil	MJ	9,35E-01	7,81E-01	7,91E-01	2,93E-03	0,00E+00	0,00E+00	3,21E-01	7,27E-01	0,00E+00	-4,80E-02
WDP	WDP (m^3) świat. ekw	1,69E-02	2,44E-03	5,57E-03	1,13E-05	0,00E+00	0,00E+00	1,22E-03	4,72E-03	0,00E+00	-7,57E-05
ADDITIONAL ENVIRONMENTAL IMPACT INDICATORS: 1 kg Knauf G-K Finish											
	Life Cycle Stage										
Indicator	**Unit**	**A1**	**A2**	**A3**	**A4**	**A5**	**C1**	**C2**	**C3**	**C4**	**D**
PM	Disease incidency	9,92E-09	4,14E-09	6,03E-10	1,13E-11	0,00E+00	0,00E+00	1,51E-09	8,40E-09	0,00E+00	-9,55E-10
IRP	kBq U235 eq.	1,01E-02	4,06E-03	2,69E-03	1,63E-05	0,00E+00	0,00E+00	1,47E-03	2,65E-03	0,00E+00	-2,13E-04
ETP-fw	CTUe	1,94E-05	3,55E-06	5,08E-05	1,83E-08	0,00E+00	0,00E+00	1,87E-06	3,82E-05	0,00E+00	-1,64E-07
HTP-c	CTUh	2,13E-11	2,24E-11	1,58E-11	1,07E-13	0,00E+00	0,00E+00	9,52E-12	1,87E-11	0,00E+00	-1,13E-12

HTP-nc	CTUh	4,25E-10	6,34E-10	6,83E-10	2,44E-12	0,00E+00	0,00E+00	2,60E-10	6,15E-10	0,00E+00	-3,17E-11
SQP	-	9,07E-02	5,13E-01	1,25E-01	1,43E-03	0,00E+00	0,00E+00	1,87E-01	1,12E-01	0,00E+00	-6,29E-03
PARAMETERS DESCRIBING RESOURCE: 1 kg Knauf G-K Finish											
	Life Cycle Stage										
Indicator	**Unit**	**A1**	**A2**	**A3**	**A4**	**A5**	**C1**	**C2**	**C3**	**C4**	**D**
PERE	MJ	8,36E-02	1,18E-02	3,41E-02	6,22E-05	0,00E+00	0,00E+00	4,32E-03	2,66E-02	0,00E+00	-2,98E-04
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	8,36E-02	1,18E-02	3,41E-02	6,22E-05	0,00E+00	0,00E+00	4,32E-03	2,66E-02	0,00E+00	-2,98E-04
PEN-RE	MJ	8,49E-01	8,12E-01	9,45E-01	3,03E-03	0,00E+00	0,00E+00	3,41E-01	8,49E-01	0,00E+00	-5,07E-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	8,49E-01	8,12E-01	9,45E-01	3,03E-03	0,00E+00	0,00E+00	3,41E-01	8,49E-01	0,00E+00	-5,07E-02
SM	kg	0,00E+00	0,00E+00	1,78E-05	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,00E+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	8,19E-06
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	1,80E-03	1,34E-04	3,27E-02	7,74E-07	0,00E+00	0,00E+00	1,15E-05	2,44E-02	0,00E+00	-7,55E-06
ENVIRONMENTAL INFORMATION DESCRIBING WASTE AND OUTPUT FLOWS: 1 kg Knauf G-K Finish											
	Life Cycle Stage										
Indicator	**Unit (expressed per DU)**	**A1**	**A2**	**A3**	**A4**	**A5**	**C1**	**C2**	**C3**	**C4**	**D**
Hazardous waste	kg	WN	WN	1,61E-05	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	1,39E-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	1,78E-05	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,00E+00	0,00E+00	0,00E+00
Materials for energy recovery	kg	WN	WN	1,71E-05	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	8,19E-06

CARBON ORGANIC	
Contents organic carbon in product (kg C_{org})	**1,07E-03**
Contents organic carbon in packaging (kg C_{org})	**9,20E-06**

Łukasiewicz
Instytut Ceramiki
i Materiałów Budowlanych

ENVIRONMENTAL PRODUCT DECLARATION
No 01-09/2023

KNAUF

CORE ENVIRMONMENTAL IMPACT INDICATORS: 1 kg Knauf MP Finish											
	Life Cycle Stage										
Indicator	**Unit**	**A1**	**A2**	**A3**	**A4**	**A5**	**C1**	**C2**	**C3**	**C4**	**D**
GWP-total	kg CO_2 eq.	4,18E-02	1,06E-01	4,33E-02	1,33E-05	0,00E+00	0,00E+00	2,23E-02	5,93E-02	0,00E+00	-3,58E-03
GWP-fossil	kg CO_2 eq.	4,12E-02	1,06E-01	4,31E-02	1,33E-05	0,00E+00	0,00E+00	2,22E-02	5,91E-02	0,00E+00	-3,57E-03
GWP-biogenic	kg CO_2 eq.	4,66E-04	9,40E-05	1,72E-04	1,36E-08	0,00E+00	0,00E+00	1,14E-05	1,31E-04	0,00E+00	-1,08E-05
GWP-luluc	kg CO_2 eq.	4,59E-05	4,81E-05	1,05E-05	7,96E-09	0,00E+00	0,00E+00	1,10E-05	9,98E-06	0,00E+00	-3,55E-07
ODP	kg CFC11 eq.	2,24E-09	2,41E-08	6,32E-09	2,91E-12	0,00E+00	0,00E+00	4,63E-09	6,58E-09	0,00E+00	-7,32E-10
AP	mol H+ eq.	1,58E-04	3,57E-04	3,29E-04	3,83E-08	0,00E+00	0,00E+00	6,58E-05	5,19E-04	0,00E+00	-3,63E-05
EP-freshwater	kg PO_4 eq.	1,94E-05	7,63E-06	5,08E-05	1,24E-09	0,00E+00	0,00E+00	1,88E-06	3,82E-05	0,00E+00	-1,64E-07
EP-marine	kg N eq.	2,43E-05	7,98E-05	4,62E-05	7,09E-09	0,00E+00	0,00E+00	1,29E-05	1,64E-04	0,00E+00	-1,57E-05
EP-terrestrial	mol N eq.	1,75E-04	8,71E-04	4,07E-04	7,70E-08	0,00E+00	0,00E+00	1,40E-04	1,73E-03	0,00E+00	-1,72E-04
POCP	kg NMVOC eq.	7,08E-05	3,04E-04	1,21E-04	2,98E-08	0,00E+00	0,00E+00	5,24E-05	4,76E-04	0,00E+00	-4,79E-05
ADP-minerals & metals	kg Sb eq.	3,57E-07	4,48E-07	1,32E-07	8,27E-11	0,00E+00	0,00E+00	9,87E-08	4,44E-08	0,00E+00	-1,84E-09
ADP-fossil	MJ	9,35E-01	1,59E+00	7,91E-01	1,98E-04	0,00E+00	0,00E+00	3,23E-01	7,27E-01	0,00E+00	-4,80E-02
WDP	WDP (m^3) świat. ekw	1,69E-02	5,13E-03	5,57E-03	7,68E-07	0,00E+00	0,00E+00	1,22E-03	4,72E-03	0,00E+00	-7,57E-05
ADDITIONAL ENVIRONMENTAL IMPACT INDICATORS: 1 kg Knauf MP Finish											
	Life Cycle Stage										
Indicator	**Unit**	**A1**	**A2**	**A3**	**A4**	**A5**	**C1**	**C2**	**C3**	**C4**	**D**
PM	Disease incidency	9,92E-09	7,83E-09	6,03E-10	7,68E-13	0,00E+00	0,00E+00	1,52E-09	8,40E-09	0,00E+00	-9,55E-10
IRP	kBq U235 eq.	1,01E-02	8,36E-03	2,69E-03	1,11E-06	0,00E+00	0,00E+00	1,48E-03	2,65E-03	0,00E+00	-2,13E-04
ETP-fw	CTUe	1,94E-05	7,63E-06	5,08E-05	1,24E-09	0,00E+00	0,00E+00	1,88E-06	3,82E-05	0,00E+00	-1,64E-07
HTP-c	CTUh	2,13E-11	4,63E-11	1,58E-11	7,24E-15	0,00E+00	0,00E+00	9,59E-12	1,87E-11	0,00E+00	-1,13E-12
HTP-nc	CTUh	4,25E-10	1,27E-09	6,83E-10	1,65E-13	0,00E+00	0,00E+00	2,61E-10	6,15E-10	0,00E+00	-3,17E-11
SQP	-	9,07E-02	9,92E-01	1,25E-01	9,67E-05	0,00E+00	0,00E+00	1,88E-01	1,12E-01	0,00E+00	-6,29E-03
PARAMETERS DESCRIBING RESOURCE: 1 kg Knauf MP Finish											
	Life Cycle Stage										
Indicator	**Unit**	**A1**	**A2**	**A3**	**A4**	**A5**	**C1**	**C2**	**C3**	**C4**	**D**
PERE	MJ	8,36E-02	2,56E-02	3,41E-02	4,21E-06	0,00E+00	0,00E+00	4,34E-03	2,66E-02	0,00E+00	-2,98E-04
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	8,36E-02	2,56E-02	3,41E-02	4,21E-06	0,00E+00	0,00E+00	4,34E-03	2,66E-02	0,00E+00	-2,98E-04
PEN-RE	MJ	8,49E-01	1,65E+00	9,45E-01	2,05E-04	0,00E+00	0,00E+00	3,43E-01	8,49E-01	0,00E+00	-5,07E-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	8,49E-01	1,65E+00	9,45E-01	2,05E-04	0,00E+00	0,00E+00	3,43E-01	8,49E-01	0,00E+00	-5,07E-02
SM	kg	0,00E+00	0,00E+00	1,78E-05	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,00E+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	8,19E-06
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	1,80E-03	2,96E-04	3,27E-02	5,24E-08	0,00E+00	0,00E+00	1,16E-05	2,44E-02	0,00E+00	-7,55E-06
ENVIRONMENTAL INFORMATION DESCRIBING WASTE AND OUTPUT FLOWS: 1 kg Knauf MP Finish											
	Life Cycle Stage										
Indicator	**Unit (expressed per DU)**	**A1**	**A2**	**A3**	**A4**	**A5**	**C1**	**C2**	**C3**	**C4**	**D**
Hazardous waste	kg	WN	WN	1,61E-05	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	1,39E-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	1,78E-05	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,00E+00	0,00E+00	0,00E+00
Materials for energy recovery	kg	WN	WN	1,71E-05	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	8,19E-06

CARBON ORGANIC	
Contents organic carbon in product (kg C_{org})	**9,92E-04**
Contents organic carbon in packaging (kg C_{org})	**9,20E-06**

5. INTERPRETATION OF LCA

Figures 2, 3 and 4 show contributions of the each life cycl module to the basic impact categories for powder mass Knauf G-K Start, G-K Finish and MP Finish.

Fig. 2 Shares of life cycle modules on main categories of influence – Knauf G-K Start:

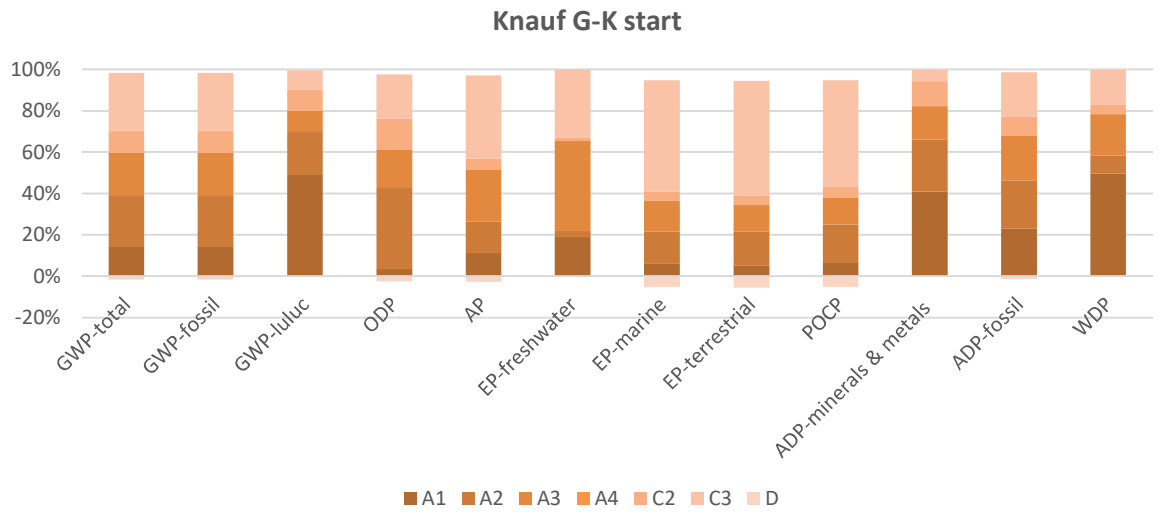


Fig. 3 Shares of life cycle modules on main categories of influence – Knauf G-K Finish:

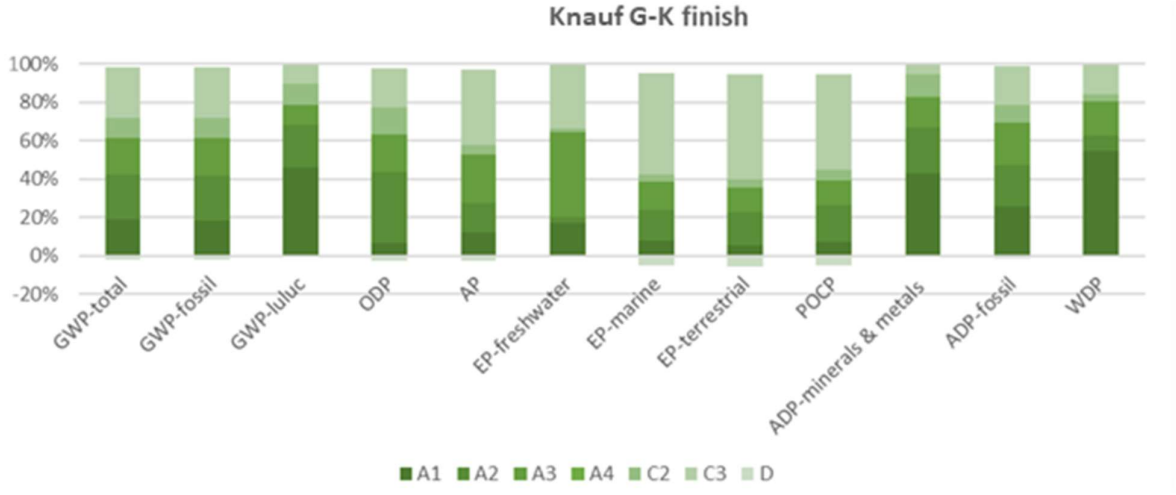
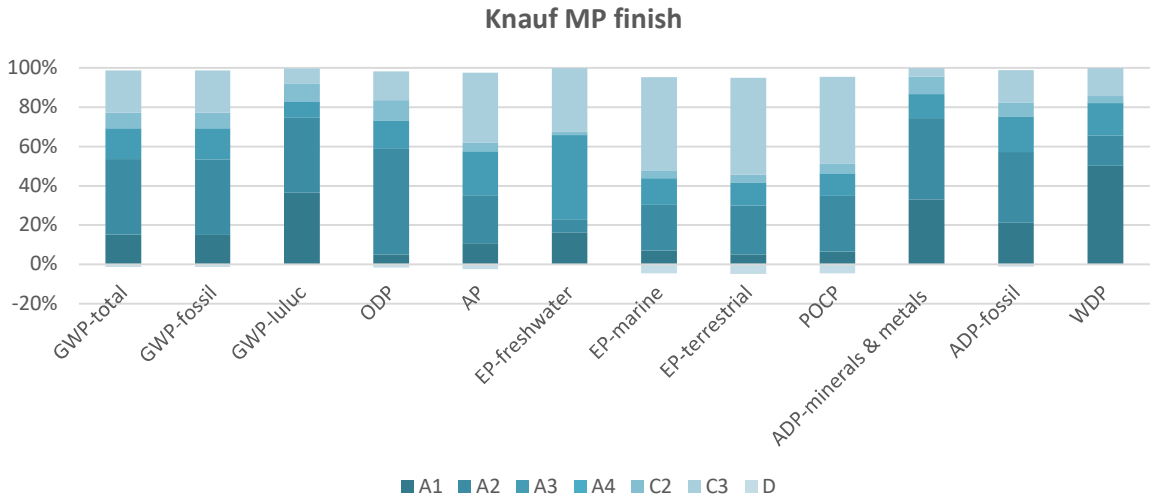


Fig. 4 Shares of life cycle modules on main categories of influence – Knauf MP Finish:



- The LCA analysis proved that the processes related to the acquisition of raw materials and semi-finished products (A1) have the greatest impact on the value of environmental impact indicators, however, the distribution between the modules of the production stage (A1-A3) is relatively homogeneous. Partial processes related to the acquisition of raw materials and energy affect the individual categories of impact to a different extent.

- Transport to the waste treatment site (module C2) has relatively minor impact on the final values of the LCIA analysis.

- The waste processing process (construction rubble containing the products covered by the declaration) also does not significantly affect the final result.
- Taking into account the above conclusions, the owner of the declaration has a moderate influence on the values of the environmental impact indicators, because it depends on external entities. It can only try to change suppliers to ones that are closer to the production plant and reduce consumption at the level of the production process.

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.
- ✓ Explanatory materials can be found on the manufacturers website: www.knauf.pl

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PROCESS ENGINEERING RESEARCH GROUP

TYPE III ENVIRONMENTAL DECLARATION CERTIFICATE

no. 01-09/2023

Products:

Powder Mass

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 **September,04 2023** and is valid for 5 years or until the said EPD is amended.

Process Engineering Research Group Leader

Ewa Głodek-Bucyk, PhD Eng.

Director of Center Of Environmental Engineering

Joanna Poluszyńska, PhD

Opole, September 2023