Environmental Product Declaration

Knauf India Private Limited| SHEETROCK© Standard Plasterboard (12.5mm and 15mm)

Declaration Owner

Knauf India Private Limited
Unit No. 610-613, 6th Floor, Vipul Trade Center, Sector-48,
Sohna Road Gurgaon-122001, Haryana, India
Info.india@knauf.com | +91-9015-147147
https://www.usgboral.com

Product

SHEETROCK® Standard Plasterboard (12.5mm and 15mm)

Functional Unit

The functional unit is 92.9 square meters of installed plasterboard with a Reference Service Life of 75-years

EPD Number and Period of Validity

SCS-EPD-07794
EPD Valid April 8, 2022 through April 7, 2027

Product Category Rule

NSF Product Category Rule for Gypsum Panel Products. Version 1.1 April 2020

Program Operator

SCS Global Services
2000 Powell Street, Ste. 600, Emeryville, CA 94608
+1.510.452.8000 | www.SCSglobalServices.com

Declaration owner:	Knauf India Private Limited
Address:	Unit No. 610-613, 6th Floor, Vipul Trade Center, Sector-48, Sohna Road Gurgaon-122001, Haryana, India
Declaration Number:	SCS-EPD-07794
Declaration Validity Period:	EPD Valid April 8, 2022 through April 7, 2027
Program Operator:	SCS Global Services
Declaration URL Link:	https://www.scsglobalservices.com/certified-green-products-guide
LCA Practitioner:	Beth Cassese, SCS Global Services
LCA Software and LCI database:	OpenLCA 1.10.3 software and the Ecoinvent v3.7.1 database
Product's Intended Application:	False ceilings, drywalls, and wall linings in both residential and commercial markets
Product RSL:	75 Years
Markets of Applicability:	India
EPD Type:	Product-Specific
EPD Scope:	Cradle-to-Grave
LCIA Method and Version:	TRACI 2.1 and CML-IA Baseline
Independent critical review of the LCA and data, according to ISO 14044 and ISO 14071	☒ internal ☐ external
LCA Reviewer:	Wan Ping Chua, SCS Global Services
Product Category Rule:	NSF Product Category Rule for Gypsum Panel Products. Version 1.1 April 2020
PCR Review conducted by:	Thomas P. Gloria, Bill Stough, Jack Geibig
Independent verification of the declaration and data, according to ISO 14025 and the PCR	☐ internal ☒ external
EPD Verifier:	Thomas Gloria, Ph.D., Industrial Ecology Consultants
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Disclaimers: *This EPD conforms to ISO 14025, 14040, 14044, and ISO 21930.*

Scope of Results Reported: *The PCR requirements limit the scope of the LCA metrics such that the results exclude environmental and social performance benchmarks and thresholds, and exclude impacts from the depletion of natural resources, land use ecological impacts, ocean impacts related to greenhouse gas emissions, risks from hazardous wastes and impacts linked to hazardous chemical emissions.*

Accuracy of Results: *Due to PCR constraints, this EPD provides estimations of potential impacts that are inherently limited in terms of accuracy.*

Comparability: *The PCR this EPD was based on was not written to support comparative assertions. EPDs based on different PCRs, or different calculation models, may not be comparable. When attempting to compare EPDs or life cycle impacts of products from different companies, the user should be aware of the uncertainty in the final results, due to and not limited to, the practitioner's assumptions, the source of the data used in the study, and the specifics of the product modeled.*

In accordance with ISO 21930:2017, EPDs are comparable only if they comply with the core PCR, use the same sub-category PCR where applicable, include all relevant information modules and are based on equivalent scenarios with respect to the context of construction works.

1. ABOUT Knauf India Private Limited

The company was established in 2006, and the Rajasthan plant has been operating since 2008. Following the USG Boral joint venture announced at the corporate level in 2013, the company was known as USG Boral India until 2021 when the company was acquired by Knauf Group and the company was rebranded as Knauf India Private Limited. Knauf India operates across India, Nepal, and Bhutan. Knauf India has established a business footprint in Pan India and are well-positioned to supply growth in India from plasterboard manufacturing facilities in Khushkhera District Alwar, Rajasthan and Sricity, Andhra Pradesh and a fully automated all-purpose joint compound and wall putty manufacturing facility at Sholavaram, Chennai.

2. PRODUCT

2.1 Product Description

SHEETROCK® Standard Plasterboard is manufactured from high purity calcium sulphate with two molecules of water stored in a crystalline form which is encased and bonded between two heavy duty paper liners. Its uniform core helps to achieve high system performance, consistent quality, strength, and ease of use.

2.2 Application

Gypsum plasterboard products are designed for a variety of applications, including false ceilings, drywalls, and wall linings in both residential and commercial markets.

2.3 Technical Data

Table 1. *SHEETROCK® Plasterboard Technical Data*

Property	Test Method	Test Results
Dimension	IS: 2095 (Part1) 2011 (RA 2016)	Satisfactory
Transverse Strength (N)	IS: 2095 (Part 1) 2011 (RA 2016)	MD 560 CD 300
Flexural Strength (N/mm^2)	IS: 2095 (P-1) – (2011 (RA 2016)	Longitudinal direction 473 Transverse direction 213

2.4 Delivery Status

Table 2. *SHEETROCK® Plasterboard Delivery Status*

SHEETROCK Plasterboard Thickness	Width	Length
12.5 mm (1.25 cm)	1220 mm (122 cm)	1830 mm (183 cm)
15 mm (1.50 cm)	1220 mm (122 cm)	1830 mm (1830 cm)

2.5 Flow Diagram

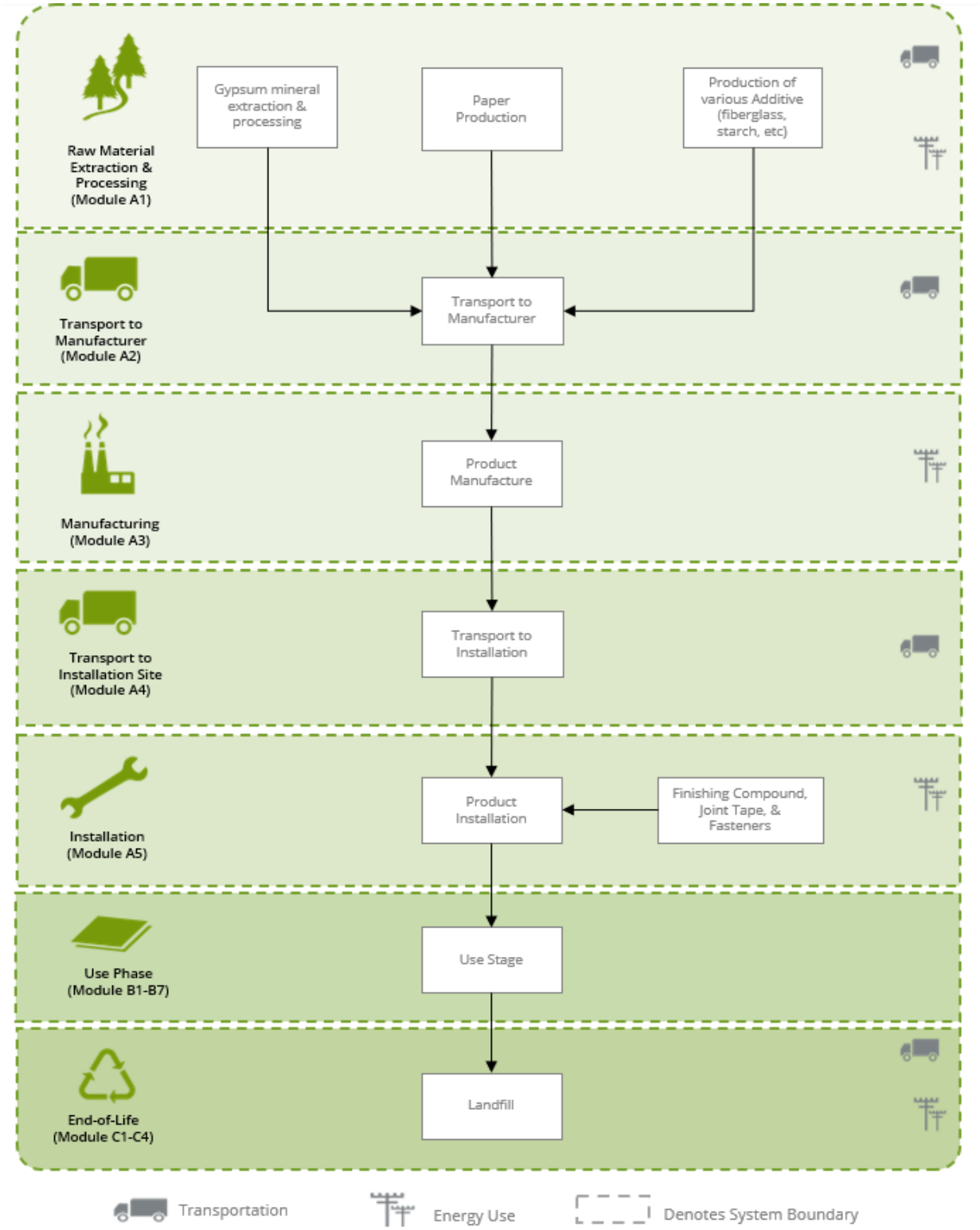


Figure 1. *Flow diagram and system boundaries for the SHEETROCK® Standard plasterboard.*

2.6 Base Materials

Table 3. *SHEETROCK® Plasterboard Material Components per 92.9 m^2.*

Product	Amount (kg)	Percentage of Total Mass	Product	Amount (kg)	Percentage of Total Mass
12.5 mm Plasterboard			**15 mm Plasterboard**		
Internal Recycle	16.1	2.21%	Internal Recycle	20.9	2.27%
Gypsum	669	92.0%	Gypsum	857	93.1%
Starch	2.76	0.38%	Starch	3.00	0.33%
Fluidizer	1.34	0.18%	Fluidizer	1.44	0.16%
Additives	1.27	0.18%	Additives	1.39	0.15%
Paper Liner	37.1	5.09%	Paper Liner	37.1	4.04%
Total	**728**	**100%**	**Total**	**921**	**100%**
Packaging			**Packaging**		
End Tape	0.411	100%	End Tape	0.411	100%
Total Packaging	**0.411**	**100%**	**Total Packaging**	**0.411**	**100%**

2.7 Manufacture

To produce plasterboard panels, gypsum is mixed with water, starch, fluidizer, internal recycle materials, and additives to form a slurry that is fed between continuous layers paper on a board machine. As the board is moved down a conveyer line, the slurry recrystallizes, reverting to its original rock. The board is then cut to length and conveyed through oven dryers to remove any free moisture.

2.8 Environment and Health during Manufacture

There are no known environmental or health programs at the manufacturing facilities.

2.9 Product Processing/ Installation

Typical installation is completed using manual labor but does require additional materials. These materials include fasteners (screws), joint tape, and joint compound.

2.10 Packaging

Plasterboard products are packaged for shipment using only paper end tape.

2.11 Condition of Use

No special conditions of use are noted.

2.12 Environment and Health during use

No environmental or health impacts are expected due to normal use of the plasterboard products.

2.13 Reference Service Life

The Reference Service Life (RSL) of the plasterboard products is 75-years. Based on the manufacturer's expertise, the product's typical life span is 50-years.

2.14 Extraordinary Effects

No environmental or health impacts are expected due to extraordinary effects including fire and/or water damage and product destruction.

2.15 Re-Use Phase

There are currently no scenarios for re-use or recycling of gypsum plasterboard products at end-of-life.

2.16 Disposal

At end-of-life, the gypsum plasterboard products may be disposed of in a landfill or via incineration, following local regulations.

2.17 Further Information

Further information on the product can be found on the manufacturer's website at https://www.usgboral.com/en_in/products/interior-panels/panels-drywall.html.

3. LCA: CALCULATION RULES

3.1 Functional Unit

The functional unit used in the study, is 92.9 m^2 of gypsum plasterboard panel over a 75-year period.

Table 4. *SHEETROCK® Plasterboard Functional Unit Properties*

SHEETROCK Plasterboard Product	Functional Unit m^2	Mass kg	Thickness cm
12.5 mm	92.9	728	1.25
15 mm	92.9	921	1.50

3.2 Estimates and Assumptions

- Electricity use at the manufacturing facilities was allocated to the products based on the product area as a fraction of the total production.
- The manufacturing facilities are located in India. An Ecoinvent inventory dataset for the Indian energy grid mix was used to model resources and emissions from electricity use at the two manufacturing facilities.
- The Reference Service Life (RSL) of the products was modeled as 75-years, as required by the PCR; however, experts at Knauf India indicated the typical product life span to be 50-years.
- The installation materials and amounts of each material are assumed based on the Knauf India online material estimator: https://www.usgboral.com/en_in/product-resources-and-tools-from-usg-boral/resources-tools/plaster-board-material-estimator.html
- Installation waste is assumed to be 10%.
- Transportation distance of the installation waste to disposal is assumed to be 100 kilometers.
- The use phase (Modules B1, B2, B3, B5, B6, B7) are assumed to have no impacts, as there is no energy or water use associated with these modules.
- The use phase replacement module (B4) is assumed to include replacement of ½ a product after the 50-year typical life span indicated by Knauf India experts, in order to meet the 75-year Reference Service Life (RSL) required by the PCR.
- For the product end-of-life, disposal of product is assumed to be in a landfill.
- Transportation distance of the product at the end-of-life is assumed to be 100 kilometers.

It should also be noted that LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks.

3.3 Cut-off criteria

According to the PCR, processes contributing greater than 1% of the total environmental impact indicator for each impact are included in the inventory. No data gaps were allowed which were expected to significantly affect the outcome of the indicator results.

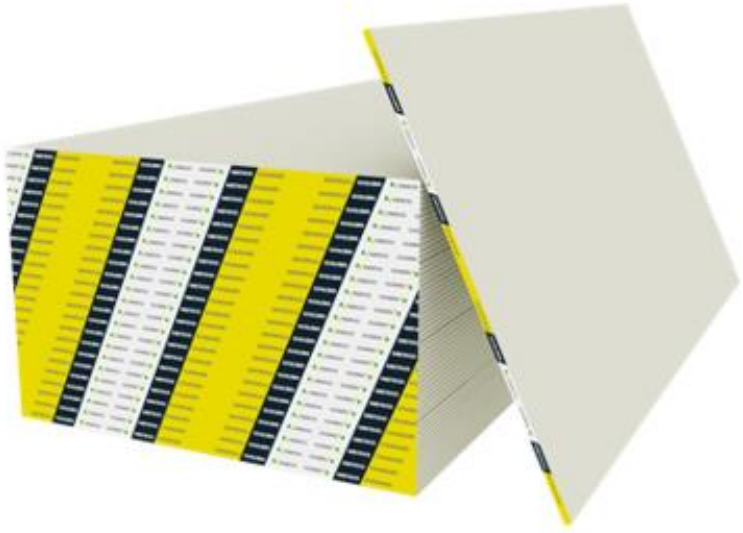
3.4 System Boundary

The scope of the EPD is cradle-to-grave, including raw material extraction and processing, transportation, product manufacture, product delivery, installation and use, and product disposal.

Table 5. *SHEETROCK® Standard Plasterboard System Boundaries.*

Product			Construction Process		Use							End-of-life				Benefits and loads beyond the system boundary
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Raw material extraction and processing	Transport to manufacturer	Manufacturing	Transport	Construction - installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction demolition	Transport	Waste processing	Disposal	Reuse, recovery and/or recycling potential
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	MND

X = Included in system boundary
MND = Module not declared



SHEETROCK® Standard Plasterboard

3.5 Background Data

Primary data were provided by Knauf India Private Limited for the Rajasthan and Andhra Pradesh facilities and from multiple suppliers of component materials for the gypsum plasterboard products. The sources of secondary LCI data are the Ecoinvent database (v3.7.1, 2020).

Table 6. *LCI datasets and associated databases used to model the Knauf India gypsum plasterboard products.*

Component	Dataset	Data Source	Publication Date
Product			
Accelerator	market for ash, from combustion of straw | ash, from combustion of straw | Cutoff, U | GLO	Ecoinvent 3.7.1	2020
	market for glucose | glucose | Cutoff, U | GLO	Ecoinvent 3.7.1	2020
	market for magnesium sulfate | magnesium sulfate | Cutoff, U | GLO	Ecoinvent 3.7.1	2020
	market for sulfate pulp, unbleached | sulfate pulp, unbleached | Cutoff, U | RoW	Ecoinvent 3.7.1	2020
	market for tap water | tap water | Cutoff, U | IN	Ecoinvent 3.7.1	2020
	market for gypsum, mineral | gypsum, mineral | Cutoff, U | IN	Ecoinvent 3.7.1	2020
	market for silica sand | silica sand | Cutoff, U | GLO	Ecoinvent 3.7.1	2020
Ammonium Sulphate	market for ammonium sulfate | ammonium sulfate | Cutoff, U |RoW	Ecoinvent 3.7.1	2020
Fiberglass	market for glass fibre | glass fibre | Cutoff, U | GLO	Ecoinvent 3.7.1	2020
Fluidizer	market for naphthalene sulfonic acid | naphthalene sulfonic acid | Cutoff, U | GLO	Ecoinvent 3.7.1	2020
	market for sodium sulfate, anhydrite | sodium sulfate, anhydrite | Cutoff, U | RoW	Ecoinvent 3.7.1	2020
	market for tap water | tap water | Cutoff, U | IN	Ecoinvent 3.7.1	2020
Foaming Agent	market for anionic resin | anionic resin | Cutoff, U | RoW	Ecoinvent 3.7.1	2020
Gypsum (Eastern Bulk)	market for gypsum, mineral | gypsum, mineral | Cutoff, U | ZA	Ecoinvent 3.7.1	2020
Gypsum (Tetarwal)	market for gypsum, mineral | gypsum, mineral | Cutoff, U | IN	Ecoinvent 3.7.1	2020
Kraft Liner	market for kraft paper | kraft paper | Cutoff, U | RoW	Ecoinvent 3.7.1	2020
Potash	market for potassium sulfate | potassium sulfate | Cutoff, U | RoW	Ecoinvent 3.7.1	2020
Retarder	market for nylon 6 | nylon 6 | Cutoff, U | RoW	Ecoinvent 3.7.1	2020
	market for tap water | tap water | Cutoff, U | IN	Ecoinvent 3.7.1	2020
Silicone	market for silicone product | silicone product | Cutoff, U | RoW	Ecoinvent 3.7.1	2020
Starch	market for maize starch | maize starch | Cutoff, U | GLO	Ecoinvent 3.7.1	2020
Vermiculite	market for vermiculite | vermiculite | Cutoff, U | GLO	Ecoinvent 3.7.1	2020
Package			
Paper	market for kraft paper | kraft paper | Cutoff, U | RoW	Ecoinvent 3.7.1	2020
Transport			
Truck	market for transport, freight, lorry >32 metric ton, EURO4 | transport, freight, lorry >32 metric ton, EURO4 | Cutoff, U | RoW	Ecoinvent 3.7.1	2020
Train	market for transport, freight train | transport, freight train | Cutoff, U | IN	Ecoinvent 3.7.1	2020
Ship	market for transport, freight, sea, container ship | transport, freight, sea, container ship | Cutoff, U | GLO	Ecoinvent 3.7.1	2020
Manufacture			
Andhra Pradesh Electricity	market for electricity, medium voltage | electricity, medium voltage | Cutoff, U | IN-southern grid	Ecoinvent 3.7.1	2020
Rajasthan Electricity	market for electricity, medium voltage | electricity, medium voltage | Cutoff, U | IN-northern grid	Ecoinvent 3.7.1	2020
Diesel	market for diesel | diesel | Cutoff, U | IN	Ecoinvent 3.7.1	2020
Natural Gas	heat production, natural gas, at industrial furnace >100kW | heat, district or industrial, natural gas | Cutoff, U | RoW	Ecoinvent 3.7.1	2020
Water	market for tap water | tap water | Cutoff, U | IN	Ecoinvent 3.7.1	2020
Waste Oil	market for hazardous waste, for incineration | hazardous waste, for incineration | Cutoff, U | RoW	Ecoinvent 3.7.1	2020
Product Disposal			
Landfill	market for inert waste, for final disposal | inert waste, for final disposal | Cutoff, U | RoW	Ecoinvent 3.7.1	2020

3.6 Data Quality

Table 7. *Data quality assessment for SHEETROCK© Standard Plasterboard.*

Data Quality Parameter	Data Quality Discussion
Time-Related Coverage: Age of data and the minimum length of time over which data is collected	The most recent available data are used, based on other considerations such as data quality and similarity to the actual operations. Typically, these data are less than 5 years old. All of the data used represented an average of a least one year's work of data collection. Manufacturer-supplied data are based on 12-months of production from July 2020 through June 2021. The time period over which inputs to and outputs from the system are accounted for is 100 years from the year for which the data set is deemed representative.
Geographical Coverage: Geographical area from which data for unit processes is collected to satisfy the goal of the study	The data used in the analysis provide the best possible representation available with current data. Electricity use for product manufacture is modeled using representative data for the regional grid in India. Surrogate data used in the assessment are representative of global or European operations. Data representative of European operations are considered sufficiently similar to actual processes.
Technology Coverage: Specific technology or technology mix	For the most part, data are representative of the actual technologies used for processing, transportation, and manufacturing operations. Representative component datasets, specific to the type of material, are used to represent the actual processes, as appropriate.
Precision: Measure of the variability of the data values for each data expressed	Precision of results are not quantified due to a lack of data. Data collected for operations were typically averaged for one more years and over multiple operations, which is expected to reduce the variability of results.
Completeness: Percentage of flow that is measured or estimated	The LCA model included all known mass and energy flows for production of the product. In some instances, surrogate data used to represent upstream and downstream operations may be missing some data which is propagated in the model. No known processes or activities contributing to more than 1% of the total environmental impact for each indicator are excluded.
Representativeness: Qualitative assessment of the degree to which the data set reflects the true population of interest	Data used in the assessment represent typical or average processes as currently reported from multiple data sources and are therefore generally representative of the range of actual processes and technologies for production of these materials. Considerable deviation may exist among actual processes on a site-specific basis; however, such a determination would require detailed data collection throughout the supply chain back to resource extraction.
Consistency: Qualitative assessment of whether the study methodology is applied uniformly to the various components of the analysis	The consistency of the assessment is considered to be high. Data sources of similar quality and age are used; with a bias towards Ecoinvent v3.7.1 data where available. Different portions of the product life cycle are equally considered.
Reproducibility: Qualitative assessment of the extent to which information about the methodology and data values would allow an independent practitioner to reproduce the results reported in the study	Based on the description of the data and assumptions used, this assessment would be reproducible by other practitioners. All assumptions, models, and data sources are documented.
Sources of the Data: Description of all primary and secondary data sources	Data representing energy use at Knauf's manufacturing facilities represent a 12-month average and are considered of high quality due to the length of time over which these data are collected, as compared to a snapshot that may not accurately reflect fluctuations in production. For secondary LCI data, Ecoinvent v3.7.1 data are used.
Uncertainty of the Information: Uncertainty related to data, models, and assumptions	Uncertainty related to materials in the products and packaging is low. Actual supplier data for upstream operations was not available for all suppliers and the study relied upon the use of existing representative datasets. These datasets contained relatively recent data (<10 years) but lacked geographical representativeness. Uncertainty related to the impact assessment methods used in the study are high. The impact assessment methodology includes impact potentials, which lack characterization of providing and receiving environments or tipping points.

3.7 Period under review

The period of review is based on a 12-month period from July 2020 through June 2021.

3.8 Allocation

Manufacturing resource use was allocated to the products based on area. Impacts from transportation were allocated based on the mass of material and distance transported.

3.9 Comparability

The PCR this EPD was based on was not written to support comparative assertions. EPDs based on different PCRs, or different calculation models, may not be comparable. When attempting to compare EPDs or life cycle impacts of products from different companies, the user should be aware of the uncertainty in the final results, due to and not limited to, the practitioner's assumptions, the source of the data used in the study, and the specifics of the product modeled.

4. LCA: SCENARIOS AND ADDITIONAL TECHNICAL INFORMATION

Delivery stage (A4)

Distribution of the plasterboard products to the point of installation was provided by the manufacturer and was modeled as 1,110 km by diesel truck and 115 km by rail freighter.

Table 8. *Module A4 Technical Information*

Truck Transport	Unit	Value
Fuel type	-	Diesel
Fuel utilization	L/100 km	18.7
Distance	km	1110
Amount of fuel	Liters	20,800
Capacity utilization		37%
Train Transport	**Unit**	**Value**
Fuel type	-	Electricity/Diesel
Fuel utilization	L/100 km	7
Distance	Km	115
Amount of fuel	Liters	806

Installation stage (A5)

Table 9. *Module A5 Technical Information per 92.9 m^2*

Installation Parameters	Unit	SHEETROCK Standard Plasterboard 12.5 mm	SHEETROCK Standard Plasterboard 15mm
Ancillary materials	kg	60.3	60.3
Fasteners	kg	3.93	3.93
Joint tape	kg	0.585	0.585
Joint compound	kg	55.7	55.7
Product loss	kg	72.8	92.1
Electricity consumption	kwh	0.00	0.00
Other energy consumption	kwh	0.00	0.00
Water consumption	m^3	0.00	0.00
Direct emissions to ambient air, soil, and water	kg	0.00	0.00
Waste materials from installation process	kg	73.2	92.5
Packaging waste Paper tape	kg	0.411	0.411
Biogenic carbon in packaging waste	kg	0.753	0.753

Use stage (B1)

No impacts are associated with the use of the product over the reference service lifetime.

Maintenance stage (B2)

No maintenance is required with the use of the product over the reference service lifetime.

Repair stage (B3)

No repair is required with the use of the product over the reference service lifetime.

Replacement stage (B4)

Replacement of the plasterboard product is assumed to take place at the end of the 50-year life span, in order to be consistent with the 75-year Reference Service Life.

Refurbishment stage (B5)

No refurbishment is required with the use of the product over the reference service lifetime.

Table 10. *Modules B1-B5 Technical Information per 92.9 m^2*

Use Phase Parameters	Unit	Use (B1)	Maintenance (B2)	Repair (B3)	Replacement (B4)	Refurbishment (B5)
Description of process	-	N/A	N/A	N/A	N/A	N/A
Direct emissions to ambient air, soil, and water	kg	0.00	0.00	0.00	0.00	0.00
Number of cycles per RSL	-	0	0	0	0	0
Number of cycles per ESL	-	0	0	0	0.5	0
Ancillary materials	kg	0.00	0.00	0.00	0.00	0.00
Energy consumption	kwh	0.00	0.00	0.00	0.00	0.00
Water consumption	m^3	0.00	0.00	0.00	0.00	0.00
Waste	kg	0.00	0.00	0.00	364 - 461	0.00

Building operation stage (B6 – B7)

There is no operational energy or water use associated with the use of the product over the reference service lifetime.

Table 11. *Modules B6-B7 Technical Information per 92.9 m^2*

Use Phase Parameters	Unit	Operational Energy Use (B6)	Operational Water Use (B7)
Type of energy carrier	-	N/A	N/A
Energy consumption	kwh	0.00	0.00
Water consumption	m^3	0.00	0.00

Disposal stage (C1 - C4)

The disposal stage includes demolition of the products (*C1*); transport of the plasterboard products to waste treatment facilities (*C2*); waste processing (*C3*); and associated emissions as the product degrades in a landfill (*C4*).

For the plasterboard product, no emissions are generated during demolition (*C1*) while no waste processing (*C3*) is required for incineration or landfill disposal. While the PCR specifies a default of 50 miles (80 km) in the absence of specific data for the transport of waste material at the end-of-life, this is specific to the North American market for the PCR. This study assumes transportation of waste materials at end-of-life (*C2*) to be 100 km in order to be more consistent with other waste transport assumptions in the study. As there are currently no known recycling or reuse scenarios for the product at

the end-of-life, the disposition at end-of-life is assumed to be inert in a landfill. As required by the PCR, only the biogenic carbon in the starch raw materials is considered for the biogenic carbon leaving the system.

Table 12. *Modules C1-C4 Technical Information per 92.9 m^2*

End-of-Life Phase Parameters	Unit	SHEETROCK Standard Plasterboard 12.5mm	SHEETROCK Standard Plasterboard 15mm
Deconstruction (C1) Energy Use	kwh	0.00	0.00
Waste Transport (C2) Distance	km	100	100
Waste Processing (C3) Energy Use	kwh	0.00	0.00
Final Disposal (C4) Landfill	kg	655	829
Biogenic Carbon Content	kg	5.05	5.51

5. LCA: RESULTS

Results of the Life Cycle Assessment are presented below. It is noted that LCA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks. All LCA results are stated to three significant figures in agreement with the PCR for this flooring product and therefore the sum of the total values may not exactly equal 100%.

The following environmental impact category indicators are reported using characterization factors using the TRACI and CML-IA impact assessment method.

TRACI 2.1 Impact Category	Unit	CMLI-A Impact Category	Unit
GWP: Global Warming Potential	kg CO_2 eq	**GWP:** Global Warming Potential	kg CO_2 eq
ODP: Ozone Depletion Potential	kg CFC 11 eq	**ODP:** Ozone Depletion Potential	kg CFC 11 eq
AP: Acidification Potential of soil and water	kg SO_2 eq	**AP:** Acidification Potential of soil and water	kg SO_2 eq
EP: Eutrophication Potential	kg N eq	**EP:** Eutrophication Potential	kg PO_4^{3-} eq
POCP:: Photochemical Oxidant Creation Potential	kg O_3 eq	**POCP:** Photochemical Oxidant Creation Potential	kg C_2H_4 eq
FFD: Fossil Fuel Depletion	MJ Surplus	**ADPE:** Abiotic Depletion Potential - Elements	kg Sb eq
		ADPF: Abiotic Depletion Potential – Fossil Fuels	MJ

These impact categories are globally deemed mature enough to be included in Type III environmental declarations. Other categories are being developed and defined and LCA should continue making advances in their development. However, the EPD users shall not use additional measures for comparative purposes.

The following inventory parameters, specified by the PCR, are also reported.

Resources	Unit	Waste and Outflows	Unit
RPR_E: Renewable primary resources used as energy carrier (fuel)	MJ, LHV	**HWD:** Hazardous waste disposed	kg
RPR_M: Renewable primary resources with energy content used as material	MJ, LHV	**NHWD:** Non-hazardous waste disposed	kg
$NRPR_E$: Non-renewable primary resources used as an energy carrier (fuel)	MJ, LHV	**RWD:** Radioactive waste, conditioned, to final repository	kg
$NRPR_M$: Non-renewable primary resources with energy content used as material	MJ, LHV	**CRU:** Components for re-use	kg
SM: Secondary materials	MJ, LHV	**MR:** Materials for recycling	kg
RSF: Renewable secondary fuels	MJ, LHV	**MER:** Materials for energy recovery	kg
NRSF: Non-renewable secondary fuels	MJ, LHV	**EE:** Recovered energy exported from the product system	MJ, LHV
RE: Recovered energy	MJ, LHV		
RPR_E: Renewable primary resources used as energy carrier (fuel)	MJ, LHV	**HWD:** Hazardous waste disposed	kg
Biogenic Carbon	**Unit**		
$BCRE_P$: Removals and emissions associated with biogenic carbon of bio-based products	kg CO_2 eq	**$BCEW_R$:** Biogenic carbon emissions from combustion of waste from renewable sources used in production	kg CO_2 eq
$BCRE_{PKG}$: Removals and emissions associated with biogenic carbon content of bio-based packaging	kg CO_2 eq	**$BCEW_{NR}$:** Biogenic carbon emissions from combustion of waste from non-renewable sources used in production	kg CO_2 eq
ECUC: Emissions from calcination and uptake from carbonation	kg CO_2 eq	**GWP:** Global Warming Potential (EN 15804)	kg CO_2 eq

Modules B1, B2, B3, B5, B6 and B7 are not associated with any impact and are therefore declared as zero. In addition, module C1 and C3 are likewise not associated with any impact as the plasterboards are manually deconstructed. Module D is not declared. In the interest of space and table readability, these modules are not included in the results presented below.

The TRACI 2.1 and CML Life Cycle Impact Assessment (LCIA) methods were selected for this study as required by the PCR and ISO 21930 for an international market. In order to be more transparent regarding the biogenic carbon uptake and emissions of biomass, the Global Warming Potential (GWP) from the EN 15804 +A2 method was also included with the required biogenic carbon indicators. Results for the gypsum plasterboard products are shown per 92.9 m^2 of product. All values are rounded to three significant digits.

SHEETROCK® Standard Plasterboard 12.5 mm Results

Table 13. *Impact indicator results for 12.5mm SHEETROCK® Standard Plasterboard.*

TRACI	Unit	A1	A2	A3	A1-A3 Total	A4	A5	B4	C2	C4
GWP	kg CO_2 eq	56.3	41.4	146	244	77.3	17.2	174	6.01	5.41
ODP	kg CFC-11 eq	$5.02x10^{-5}$	$9.74x10^{-6}$	$1.11x10^{-5}$	$7.11x10^{-5}$	$1.83x10^{-5}$	$1.67x10^{-6}$	$4.70x10^{-5}$	$1.46x10^{-6}$	$1.94x10^{-6}$
AP	kg SO_2 eq	0.402	0.454	0.303	1.16	0.358	0.074	0.823	0.027	0.041
EP	kg N eq	0.494	0.050	0.226	0.770	0.092	0.074	0.474	0.007	0.009
POCP	kg O_3 eq	7.68	9.17	4.11	21.0	8.60	1.20	16.1	0.663	1.02
FFD	MJ Surplus	81.5	87.8	256	425	166	17.9	319	13.3	18.1
CML	**Unit**	**A1**	**A2**	**A3**	**A1-A3 Total**	**A4**	**A5**	**B4**	**C2**	**C4**
GWP	kg CO_2 eq	56.6	41.4	147	245	77.4	17.4	174	6.02	5.42
ODP	kg CFC-11 eq	$4.83x10^{-5}$	$7.31x10^{-6}$	$8.25x10^{-6}$	$6.39x10^{-5}$	$1.37x10^{-5}$	$1.30x10^{-6}$	$4.06x10^{-5}$	$1.10x10^{-6}$	$1.46x10^{-6}$
AP	kg SO_2 eq	0.348	0.416	0.289	1.05	0.305	0.069	0.737	0.023	0.035
EP	kg PO_4^{3-} eq	0.250	0.061	0.114	0.424	0.074	0.036	0.272	0.005	0.008
POCP	kg C_2H_4 eq	0.014	0.011	0.016	0.041	0.010	0.005	0.029	0.001	0.001
ADPE	kg Sb eq	$3.90x10^{-4}$	$8.56x10^{-5}$	$5.35x10^{-5}$	$5.29x10^{-4}$	$1.80x10^{-4}$	$3.70x10^{-4}$	$5.50x10^{-4}$	$1.41x10^{-5}$	$1.50x10^{-5}$
ADPF	MJ	724	607	2060	3390	1180	198	2480	92.4	125

Table 14. *Additional transparency indicators for the 12.5 mm SHEETROCK® Standard plasterboard products.*

Resource Use	Unit	A1	A2	A3	A1-A3 Total	A4	A5	B4	C2	C4
RPR_E	MJ	1450	6.01	56.0	1510	14.2	35.4	782	1.02	1.28
RPR_M	MJ	2070	0.00	0.00	2070	0.00	0.00	1040	0.00	0.00
$NRPR_E$	MJ	758	614	2090	3460	1190	218	2530	93.7	127
$NRPR_M$	MJ	INA	INA	INA	INA	INA	INA	INA	INA	INA
SM	kg	39.2	0.00	0.00	39.2	0.00	0.00	19.6	0.00	0.00
RSF	MJ	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
NRSF	MJ	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
RE	MJ	INA	INA	INA	INA	INA	INA	INA	INA	INA
FW	m^3	0.568	0.077	0.541	1.19	0.174	0.187	0.841	0.013	0.110
Waste and Output	**Unit**	**A1**	**A2**	**A3**	**A1-A3 Total**	**A4**	**A5**	**B4**	**C2**	**C4**
HWD	kg	0.005	0.001	0.001	0.007	0.003	0.003	0.007	$2.30x10^{-4}$	$2.20x10^{-4}$
NHWD	kg	26.9	40.6	4.29	71.8	100	78.2	493	8.08	657
RWD	kg	0.003	0.004	$8.00x10^{-4}$	0.008	0.008	$8.00x10^{-4}$	0.009	$6.20x10^{-4}$	$8.30x10^{-4}$
CRU	kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MR	kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MER	kg	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
EE	MJ, LHV	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
Biogenic Carbon	**Unit**	**A1**	**A2**	**A3**	**A1-A3 Total**	**A4**	**A5**	**B4**	**C2**	**C4**
$BCRE_P$	kg CO_2 eq	-5.35	0.00	0.00	-5.35	0.00	0.00	-2.67	0.00	0.00
$BCRE_{PKG}$	kg CO_2 eq	0.00	0.00	-0.281	-0.281	0.00	0.00	-0.140	0.00	0.00
ECUC	kg CO_2 eq	INA	INA	INA	INA	INA	INA	INA	INA	INA
$BCEW_R$	kg CO_2 eq	INA	INA	INA	INA	INA	INA	INA	INA	INA
$BCEW_{NR}$	kg CO_2 eq	INA	INA	INA	INA	INA	INA	INA	INA	INA
GWP (EN 15804)	kg CO2 eq	25.0	41.9	149	216	78.3	17.9	161	6.09	5.53

INA = Indicator not assessed, | Neg.= Negligible

SHEETROCK® Standard Plasterboard 15 mm Results

Table 15. *Impact indicator results for 15mm SHEETROCK® Standard Plasterboard.*

TRACI	Unit	A1	A2	A3	A1-A3 Total	A4	A5	B4	C2	C4
GWP	kg CO_2 eq	61.2	51.6	146	259	97.8	17.4	193	7.61	6.84
ODP	kg CFC-11 eq	$5.42x10^{-5}$	$1.21x10^{-5}$	$1.11x10^{-5}$	$7.74x10^{-5}$	$2.32x10^{-5}$	$1.73x10^{-6}$	$5.31x10^{-5}$	$1.85x10^{-6}$	$2.46x10^{-6}$
AP	kg SO_2 eq	0.440	0.566	0.303	1.31	0.453	0.075	0.952	0.035	0.052
EP	kg N eq	0.504	0.062	0.226	0.792	0.117	0.074	0.499	0.008	0.011
POCP	kg O_3 eq	8.52	11.4	4.11	24.1	10.9	1.23	19.0	0.839	1.30
FFD	MJ Surplus	90.8	110	256	456	210	18.4	360	16.8	22.9
CML	**Unit**	**A1**	**A2**	**A3**	**A1-A3 Total**	**A4**	**A5**	**B4**	**C2**	**C4**
GWP	kg CO_2 eq	61.4	51.7	147	260	98.0	17.6	194	7.62	6.86
ODP	kg CFC-11 eq	$5.20x10^{-5}$	$9.11x10^{-6}$	$8.25x10^{-6}$	$6.94x10^{-5}$	$1.74x10^{-5}$	$1.35x10^{-6}$	$4.55x10^{-5}$	$1.39x10^{-6}$	$1.84x10^{-6}$
AP	kg SO_2 eq	0.379	0.519	0.289	1.19	0.386	0.070	0.850	0.030	0.044
EP	kg PO_4^{3-} eq	0.258	0.075	0.114	0.448	0.093	0.037	0.295	0.007	0.010
POCP	kg C_2H_4 eq	0.015	0.014	0.016	0.045	0.013	0.005	0.032	0.001	0.002
ADPE	kg Sb eq	$4.10x10^{-4}$	$1.10x10^{-4}$	$5.35x10^{-5}$	$5.73x10^{-4}$	$2.30x10^{-4}$	$3.70x10^{-4}$	$6.00x10^{-4}$	$1.79x10^{-5}$	$1.90x10^{-5}$
ADPF	MJ	794	757	2060	3610	1490	202	2770	117	158

Table 16. *Additional transparency indicators for the 15 mm SHEETROCK® Standard plasterboard products.*

Resource Use	Unit	A1	A2	A3	A1-A3 Total	A4	A5	B4	C2	C4
RPR_E	MJ	1460	7.49	56.0	1520	18.0	35.5	789	1.29	1.62
RPR_M	MJ	2070	0.00	0.00	2070	0.00	0.00	1040	0.00	0.00
$NRPR_E$	MJ	830	766	2090	3690	1510	222	2830	119	160
$NRPR_M$	MJ	INA	INA	INA	INA	INA	INA	INA	INA	INA
SM	kg	39.3	0.00	0.00	39.3	0.00	0.00	19.6	0.00	0.00
RSF	MJ	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
NRSF	MJ	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
RE	MJ	INA	INA	INA	INA	INA	INA	INA	INA	INA
FW	m^3	0.583	0.095	0.541	1.22	0.220	0.190	0.901	0.017	0.139
Waste and Output	**Unit**	**A1**	**A2**	**A3**	**A1-A3 Total**	**A4**	**A5**	**B4**	**C2**	**C4**
HWD	kg	0.005	0.002	0.001	0.008	0.004	0.003	0.007	$2.90x10^{-4}$	$2.80x10^{-4}$
NHWD	kg	30.8	50.7	4.29	85.8	127	97.7	621	10.2	831
RWD	kg	0.004	0.005	$8.00x10^{-4}$	0.010	0.010	$8.20x10^{-4}$	0.011	$7.90x10^{-4}$	0.001
CRU	kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MR	kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MER	kg	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
EE	MJ, LHV	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
Biogenic Carbon	**Unit**	**A1**	**A2**	**A3**	**A1-A3 Total**	**A4**	**A5**	**B4**	**C2**	**C4**
$BCRE_P$	kg CO_2 eq	-5.83	0.00	0.00	-5.83	0.00	0.00	-2.92	0.00	0.00
$BCRE_{PKG}$	kg CO_2 eq	0.00	0.00	-0.281	-0.281	0.00	0.00	-0.140	0.00	0.00
ECUC	kg CO_2 eq	INA	INA	INA	INA	INA	INA	INA	INA	INA
$BCEW_R$	kg CO_2 eq	INA	INA	INA	INA	INA	INA	INA	INA	INA
$BCEW_{NR}$	kg CO_2 eq	INA	INA	INA	INA	INA	INA	INA	INA	INA
GWP (EN 15804)	kg CO2 eq	29.5	52.2	149	231	99.1	18.1	180	7.71	7.00

INA = Indicator not assessed, | Neg.= Negligible

6. LCA: INTERPRETATION

The interpretation phase conforms to ISO 14044.The interpretation included the use of evaluation and sensitivity checks to steer the iterative process during the assessment, and a final evaluation including completeness, sensitivity, and consistency checks, at the end of the study.

The main contributions to indicator results are from the manufacturing phase (A3), replacement phase (B4), and the product distribution phase (A4). Of the remaining life cycle stages, the raw materials extraction and processing phase (A1) and raw material transportation phase (A2) are also significant contributors to the overall impacts for the gypsum plasterboard products.

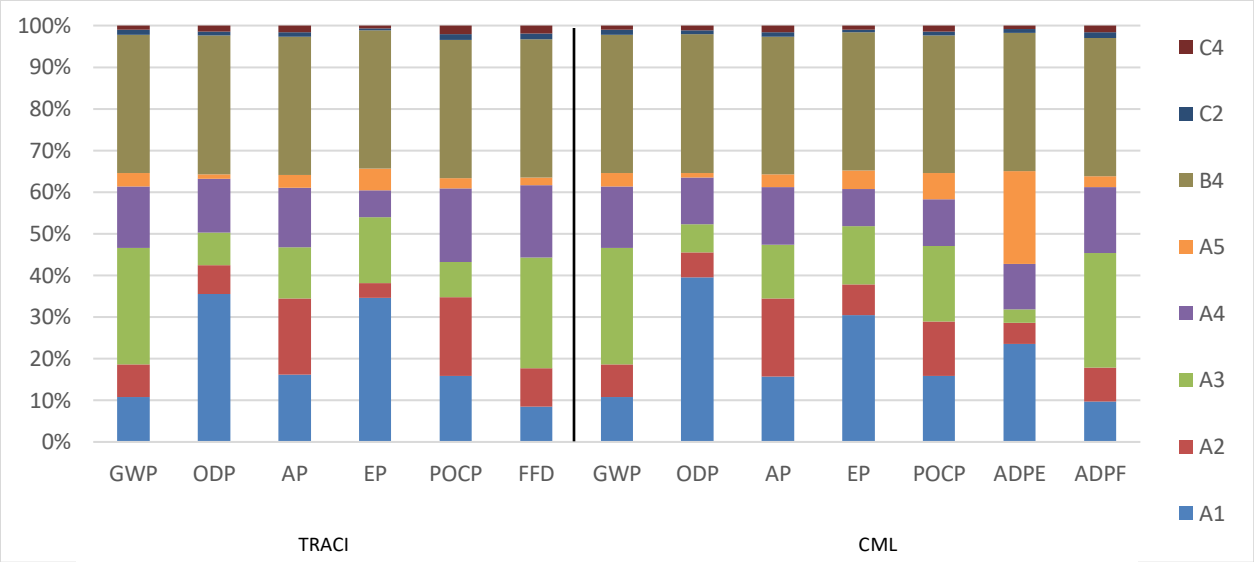


Figure 2. *Contribution analysis for the 12.5 mm SHEETROCK® Standard Plasterboard.*

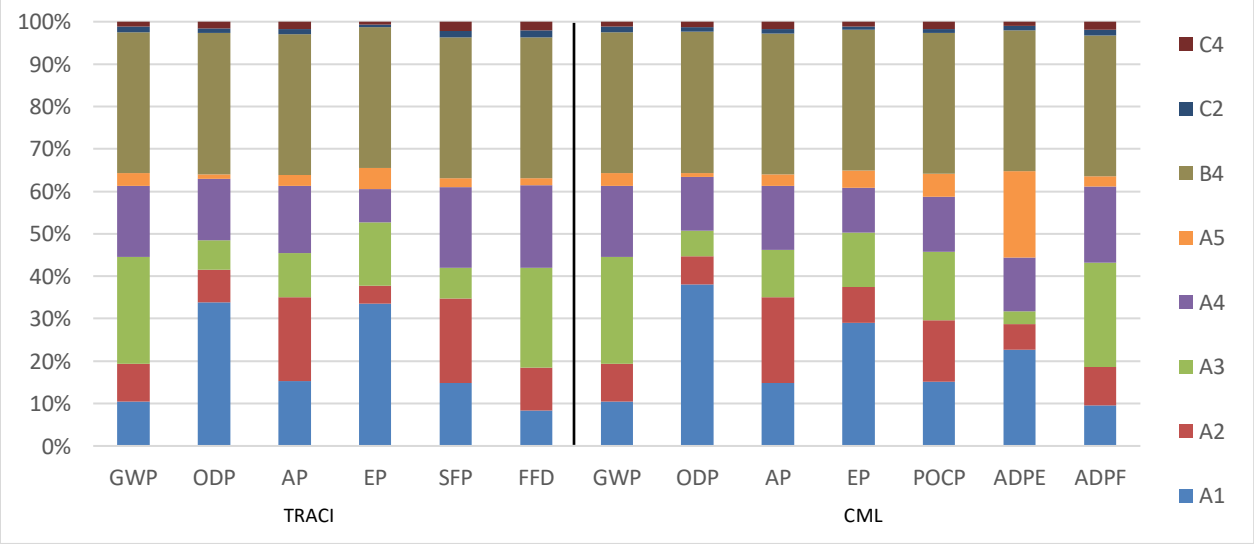


Figure 3. *Contribution analysis for the 15 mm SHEETROCK® Standard Plasterboard.*

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For more information please contact

Knauf India Private Limited
Unit No. 610-613, 6th Floor, Vipul Trade Center, Sector-48, Sohna Road Gurgaon-122001, Haryana, India
Info.india@knauf.com | +91-9015-147147 | https://www.usgboral.com

SCS Global Services
2000 Powell Street, Ste. 600, Emeryville, CA 94608 USA
Main +1.50.452.8000 | fax +1.510.452.8001