EPD®
THE INTERNATIONAL EPD® SYSTEM

TURKEY EPD®
ENVIRONMENTAL PRODUCT DECLARATIONS

KNAUF

ENVIRONMENTAL PRODUCT DECLARATION

In acc. with ISO 14025 and EN 15804+A1 for plasterboards from İzmit Plant

Flex Alçıpan® (FX)

Suya Dayanıklı Alçıpan® (WR)

Yangına Dayanıklı Alçıpan® (FR)

Suya ve Yangına Dayanıklı Alçıpan® (WRFR)

Mouldboard® (MWR)

Mouldboard® (MWFR)

Diamant®

General Information

Information about the organization

Owner of the declaration:	Knauf AŞ	
Production site:	İzmit Plant	
Contact person:	Derya Göksel +90 (312) 297 00 36 goksel.derya@knauf.com.tr	
Programme:	EPD® Turkey, a fully aligned regional programme www.epdturkey.org	The International EPD® System www.environdec.com
Programme operator:	EPD® Turkey SÜRATAM Turkish Centre for Sustainable Production Research & Design Nef 09 B Blok No:7/15, 34415 Kağıthane/İstanbul, Turkey www.suratam.org	EPD® International AB
EPD® registration number:	S-P-01264	
Publication date:	28.11.2018	
Validity date:	25.11.2023	
Geographical scope:	Global	

Owner of the EPD®:
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Name and location of production site:
Knauf İzmit Plant
Çuhane Caddesi No:30
41140 İzmit / TÜRKİYE

PCR Identification: EN 15804 (Core PCR); PCR 2012:01; Construction Products and Construction Services Version 2.2

EPD® of construction products may not be comparable if they do not comply with EN 15804.

About the Company

Knauf is one of the world's leading manufacturers of modern insulation materials, dry lining systems, plasters and accessories, thermal insulation composite systems, paints, floor screed, floor systems, and construction equipment and tools. With 150 production facilities and sales organizations in over 86 countries, 27,500 employees worldwide, and sales of 6.5 billion Euro (in 2016), the Knauf Group is without doubt one of the big players on the market – in Europe, the USA, South America, Russia, Asia, Africa, and Australia.

Specifically the family company was established in 1932, when brothers Alfons and Karl Knauf secured the mining rights to gypsum deposits in the Schengen community (Obermosel) in Germany. Courage, determination, and business savy were the reasons that only a year later Knauf established its first gypsum factory in Perl (Moselle) – laying the foundation for what would later be the Knauf Group.

The story of the company in Turkey began in 1989, as Biltepe AŞ, starting production in Ankara plant as the first gypsum board factory of Turkey. In the second half of 1997, the firm engaged in a merger with Knauf, a world leader in this field. From 2000 on, the investments proceeded under 100% Knauf ownership. That very year also marked the opening of the second gypsum board factory in İzmit, Turkey, followed by a third plant again in İzmit. One of the largest plants of Europe, Knauf's fourth plant in Turkey, the Ahiboz, Ankara factory began production in 2009.

Product Information

The declared plasterboards consist of a gypsum core and a boardliner wrapping the gypsum core. The gypsum core also contains additives. These products are used for installing partition walls, drywall lining, shaft wall and suspended ceiling systems in interiors.

The product UN CPC code is 37520

Products	Type (TS EN 520)	Weight (kg/m²)	Application Area	System
Flex Alçıpan® (FX)	A	7,7	Standard drywall application with no special requirements	Partition wall, suspended ceiling, wall cladding
Suya Dayanıklı Alçıpan® (WR)	H	8,2	Drywall application in wet rooms such as domestic bathroom, kitchen etc.	Partition wall, suspended ceiling, wall cladding
Suya ve Yangına Dayanıklı Alçıpan® (WRFR)	HF	9,6	Drywall application in wet rooms with fire resistance requirements	Partition wall, suspended ceiling, wall cladding, shaft walls
Yangına Dayanıklı Alçıpan® (FR)	F	9,6	Drywall application with fire resistance requirements	Partition wall, suspended ceiling, wall cladding, shaft walls
Mouldboard® (MWR)	H	10,5	Drywall application in wet rooms with mould resistance requirements	Partition wall, suspended ceiling, wall cladding
Mouldboard® (MWFR)	HF	10,5	Drywall application in wet rooms with mould and fire resistance requirements	Partition wall, suspended ceiling, wall cladding, shaft walls
Diamant®	DFH2IR	10,5	Drywall application in rooms with impact resistant, sound insulation, fire and moisture resistance requirements	Partition wall, wall cladding, shaft walls

LCA Information

Functional unit / declared unit:
1 m² of plasterboard with thickness 12,5 mm

Reference service life:
Since there are no influences on ageing of the gypsum boards during use following the rules of engineering. According to /BBSR2017/ a service life of at least 50 years can be considered for gypsum plasterboards in general.

Time representativeness:
2017

Database(s) and LCA software used:
For modelling the LCA the software GaBi 8 from Thinkstep is used. The LCA is based on production data.

Description of system boundaries:
Type of EPD®: Cradle-to-gate with Options

- Declared modules are A1-A3, A4, C2, C4
- The use stage (Module B1 to B7) as well as the deconstruction, demolition (Module C1) stages are neglected. The declared plasterboards constitute passive construction products, thus, there aren't any specific environmental impact potentials during the use and the deconstruction phases. Minor damages can be repaired by applying suitable fillers.
- Installation into the building (Module A5) is not taken into consideration in the framework of this EPD®; due to the manual assembly (with cordless screwdriver for drywalls), only very low environmental impacts are expected from this module.
- Since there is no waste processing at the end of life, modules C3 and D are not applicable. The declared plasterboards are typically disposed of as municipal waste which is declared in module C4.

Allocation: The production does not deliver any co-products, therefore product allocations are not applied in the calculation model.

Assumptions: A general utilization ratio of 50% was assumed for transportation of raw materials, finished plasterboards, and demolished debris material.

A standard distance of 100 km was assumed with a capacity utilization of 50% for the transportation of the plasterboards from the location of production to the final customer (Module A4) as well as the transportation from the construction site to the landfill (Module C2).

Data quality: The LCA of Knauf Flex Alçıpan® (FX), Suya Dayanıklı Alçıpan® (WR), Suya ve Yangına Dayanıklı Alçıpan® (WRFR), Yangına Dayanıklı Alçıpan® (FR), Mouldboard® (MWR), Mouldboard® (MWFR), Diamant® are modelled by using GaBi datasets, exclusively. The background data are no older than 5 years. Therefore, the data quality is considered to be good.

Impact methodology applied: CML 2001 – January 2016

Life Cycle Stages

Product stage:

- A1, Supply of raw materials
    - o Mining of gypsum stone
    - o Provision of further mineral ingredients
    - o Provision of additives and board line
    - o Provision of board liner (paper) out of waste paper
- A2, Transport of raw materials
    - o Transport of raw material to the location of production
- A3, Manufacturing
    - o Calcination of natural gypsum to become Stucco (hemi-hydrate) plaster
    - o Production of plasterboards
    - o Supply of electrical and thermal energy
    - o Packaging of the plasterboards for the transport
    - o Recycling and production waste and on an external landfill

Manufacture

The components of Knauf plaster boards are suspended in silos in liquid phase and spread on a continuous sheet of board liner (visible face, lower layer). The board liner is cut on the sides for edge shaping.

The slurry is covered with a second sheet of board liner (back surface) in the forming station and the edges of the visible face board liner are flipped upwards. On the subsequent board liner the gypsum sets continuously and is dried in a multi-level drier to the permitted residual moisture level. Drying is followed by the cutting of the boards to the desired lengths. (See also figure below)

Construction process stage:
- A4, transport to the building site
For the transport of the plasterboards from the location of production to the final customer, a distance of 100 km per truck is assumed with a capacity utilization of 50% (A4). This does not necessarily correspond to the actual distance. However, in this way, the environmental load potentials associated with the transport may be easily converted to the relevant situation on building site by means of extrapolation.

End-of-life stage:
- C2, transport from the building site to the landfill
As in Module A4, a transport distance of 100 km per truck was also taken as a basis for the transport from the construction site to the landfill (Module C2), in order to facilitate the extrapolation and interpolation, of the environmental load potentials on the individual transport distance on building site.

Vehicle type	Truck-trailer, Euro 5, 34 - 40 t gross weight / 27 t payload capacity
Transport distance A4	100 km
Transport distance C2	100 km
Capacity utilisation (including empty runs)	50 %

General modeling information for transports in A4 and C2

- C4, Disposal

Construction waste are disposed of in convenient landfills (municipal landfill).

Content Declaration

Product

Declared Knauf plasterboards are primarily made of special gypsum core (> 90 %) with small amount of additives (< 5 %) covered with a board liner.

The declared products contain no or below 0.1 % of hazardous substances listed on the Candidate list of Substances of Very High Concern, last updated: 2018-06-27.

VOC levels of our products are tested by AgBB scheme according to the worst case scenario. The product containing all of the additives is tested. The results are given as below.

AgBB	**Chamber testing**			
	3 days [µg/m³]	**Requirement [µg/m³]**	**28 days [µg/m³]**	**Requirement [µg/m³]**
TVOC (C 6 – C 16)	< 100	≤ 10.000	0	≤ 1.000
TSVOC (C 16 – C 22)	0	None	0	≤ 100
Sum Ri (dimensionless)	< 0,5	None	0	≤ 1
Sum VOC without LCI*	0	None	0	≤ 100
Sum Cancerogenic	0	≤ 10	0	≤ 1
Formaldehyde	<100	None	< 10	≤ 100
Sum VVOC	<100	None	0	None
TVOC (C6 – C16) as toluene equivalent	<100	None	0	None
AgBB scheme	fulfilled			

*LCI – lowest concentration of interest

Packaging:
Only gypsum board stripes are used for the packaging of plasterboards. The boards are not packaged separately; they are stapled on stripes made of gypsum boards.

Recycled material:
One half of the production waste is recycled back into production as gypsum (stucco), and the other half of the waste is disposed of in external landfill sites.

In Turkey, there aren't any suitable recycling facilities for the gypsum waste yet. Therefore, for the present Environmental Product Declaration, only the landfill at the end of the life cycle has been assumed: Construction waste are disposed of in convenient landfills (municipal landfill).

Environmental Performance

Description of the System Boundaries:

Raw material supply (extraction, processing, recycled material)	**A1**	X
Transport to manufacturer	**A2**	X
Manufacturing	**A3**	X
Transport to building site	**A4**	X
Installation into building	**A5**	MND
Use / application	**B1**	MND
Maintenance	**B2**	MND
Repair	**B3**	MND
Replacement	**B4**	MND
Refurbishment	**B5**	MND
Operational energy use	**B6**	MND
Operational water use	**B7**	MND
Deconstruction / demolition	**C1**	MND
Transport to EoL	**C2**	X
Waste processing for reuse, recovery or recycling	**C3**	MND
Disposal	**C4**	X
Reuse, recovery or recycling potential	**D**	MND

(X = declared module; MND = module not declared)

Since all board types differ in their composition, the results are given below in separate tables per individual board type.

The results of the life cycle assessment for the plasterboards Flex Alçıpan® (FX), Suya Dayanıklı Alçıpan® (WR), Yangına Dayanıklı Alçıpan® (FR), Suya ve Yangına Dayanıklı Alçıpan® (WRFR) , Mouldboard® (MWR), Mouldboard® (MWFR), Diamant® are shown in tables below.

Flex Alçıpan® (FX)

ENVIRONMENTAL IMPACTS					
Parameter	**Unit**	**A1-3**	**A4**	**C2**	**C4**
GWP	[kg CO_2-eq.]	1,55E+00	5,23E-02	5,12E-02	1,24E-01
ODP	[kg CFC11-eq.]	4,43E-12	1,74E-14	1,70E-14	1,17E-13
AP	[kg SO_2-eq.]	4,04E-03	1,37E-04	1,34E-04	7,35E-04
EP	[kg PO_4^{3-}-eq.]	7,50E-04	3,31E-05	3,24E-05	1,00E-04
POCP	[kg ethene-eq.]	3,05E-04	-4,73E-05	-4,64E-05	5,78E-05
ADPE	[kg Sb-eq.]	2,83E-04	4,20E-09	4,12E-09	4,37E-08
ADPF	[MJ]	2,31E+01	7,16E-01	7,02E-01	1,61E+00
Caption	GWP = Global warming potential; ODP = Ozone depletion potential; AP = Acidification potential; EP = Eutrophication potential; POCP = Photochemical ozone creation potential; ADPE = Abiotic depletion potential for non fossil resources; ADPF = Abiotic depletion potential for fossil resources				

RESOURCE USE					
Parameter	**Unit**	**A1-3**	**A4**	**C2**	**C4**
PERE	[MJ]	1,03E+01	3,60E-02	3,53E-02	1,94E-01
PERM	[MJ]	3,20E-01	0,00E+00	0,00E+00	0,00E+00
PERT	[MJ]	1,06E+01	3,60E-02	3,53E-02	1,94E-01
PENRE	[MJ]	2,33E+01	7,18E-01	7,04E-01	1,66E+00
PENRM	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PENRT	[MJ]	2,33E+01	7,18E-01	7,04E-01	1,66E+00
SM	[kg]	3,30E-01	0,00E+00	0,00E+00	0,00E+00
RSF	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00
NRSF	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00
FW	[m^3]	8,54E-03	6,67E-05	6,54E-05	3,16E-04
Caption	PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non renewable primary energy excluding non renewable primary energy resources used as raw materials; PENRM = Use of non renewable primary energy resources used as raw materials, PENRT = Total use of non renewable primary energy resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non renewable secondary fuels; FW = Use of net fresh water				

OUTPUT FLOWS AND WASTE CATEGORIES					
Parameter	**Unit**	**A1-3**	**A4**	**C2**	**C4**
HWD	[kg]	6,60E-04	3,77E-08	3,70E-08	2,63E-08
NHWD	[kg]	3,72E-01	5,49E-05	5,38E-05	7,71E+00
RWD	[kg]	8,30E-05	9,80E-07	9,61E-07	2,25E-05
CRU	[kg]	0,00E+00	0,00E+00	0,00E+00	0,00E+00
MFR	[kg]	7,00E-03	0,00E+00	0,00E+00	0,00E+00
MER	[kg]	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EEE	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EET	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Caption	HWD = Hazardous waste disposed; NHWD = Non hazardous waste disposed; RWD = Radioactive waste disposed; CRU = Components for re-use; MFR = Materials for recycling; MER = Materials for energy recovery; EEE = Exported electrical energy; EET = Exported thermal energy				

Life Cycle Assessment and Life Cycle Inventory Results of the plasterboard Flex Alçıpan® (FX)

Suya Dayanıklı Alçıpan® (WR)

ENVIRONMENTAL IMPACTS					
Parameter	**Unit**	**A1-3**	**A4**	**C2**	**C4**
GWP	[kg CO_2-eq.]	1,79E+00	5,56E-02	5,46E-02	1,32E-01
ODP	[kg CFC11-eq.]	5,26E-12	1,85E-14	1,82E-14	1,25E-13
AP	[kg SO_2-eq.]	4,55E-03	1,46E-04	1,43E-04	7,83E-04
EP	[kg PO_4^{3-}-eq.]	8,31E-04	3,52E-05	3,45E-05	1,07E-04
POCP	[kg ethene-eq.]	3,57E-04	-5,04E-05	-4,94E-05	6,16E-05
ADPE	[kg Sb-eq.]	3,06E-04	4,47E-09	4,39E-09	4,65E-08
ADPF	[MJ]	2,66E+01	7,61E-01	7,47E-01	1,71E+00
Caption	GWP = Global warming potential; ODP = Ozone depletion potential; AP = Acidification potential; EP = Eutrophication potential; POCP = Photochemical ozone creation potential; ADPE = Abiotic depletion potential for non fossil resources; ADPF = Abiotic depletion potential for fossil resources				

RESOURCE USE					
Parameter	**Unit**	**A1-3**	**A4**	**C2**	**C4**
PERE	[MJ]	1,14E+01	3,83E-02	3,76E-02	2,07E-01
PERM	[MJ]	3,20E-01	0,00E+00	0,00E+00	0,00E+00
PERT	[MJ]	1,17E+01	3,83E-02	3,76E-02	2,07E-01
PENRE	[MJ]	2,70E+01	7,64E-01	7,50E-01	1,77E+00
PENRM	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PENRT	[MJ]	2,70E+01	7,64E-01	7,50E-01	1,77E+00
SM	[kg]	3,30E-01	0,00E+00	0,00E+00	0,00E+00
RSF	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00
NRSF	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00
FW	[m^3]	9,69E-03	7,10E-05	6,97E-05	3,36E-04
Caption	PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non renewable primary energy excluding non renewable primary energy resources used as raw materials; PENRM = Use of non renewable primary energy resources used as raw materials, PENRT = Total use of non renewable primary energy resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non renewable secondary fuels; FW = Use of net fresh water				

OUTPUT FLOWS AND WASTE CATEGORIES					
Parameter	**Unit**	**A1-3**	**A4**	**C2**	**C4**
HWD	[kg]	6,60E-04	4,01E-08	3,94E-08	2,80E-08
NHWD	[kg]	4,45E-01	5,84E-05	5,73E-05	8,21E+00
RWD	[kg]	1,40E-04	1,04E-06	1,02E-06	2,39E-05
CRU	[kg]	0,00E+00	0,00E+00	0,00E+00	0,00E+00
MFR	[kg]	7,00E-03	0,00E+00	0,00E+00	0,00E+00
MER	[kg]	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EEE	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EET	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Caption	HWD = Hazardous waste disposed; NHWD = Non hazardous waste disposed; RWD = Radioactive waste disposed; CRU = Components for re-use; MFR = Materials for recycling; MER = Materials for energy recovery; EEE = Exported electrical energy; EET = Exported thermal energy				

Life Cycle Assessment and Life Cycle Inventory Results of the plasterboard Suya Dayanıklı Alçıpan® (WR)

Yangına Dayanıklı Alçıpan® (FR)

ENVIRONMENTAL IMPACTS					
Parameter	**Unit**	**A1-3**	**A4**	**C2**	**C4**
GWP	[kg CO_2-eq.]	1,92E+00	6,49E-02	6,39E-02	1,54E-01
ODP	[kg CFC11-eq.]	4,42E-12	2,16E-14	2,13E-14	1,46E-13
AP	[kg SO_2-eq.]	5,12E-03	1,70E-04	1,67E-04	9,16E-04
EP	[kg PO_4^{3-}-eq.]	8,64E-04	4,11E-05	4,04E-05	1,25E-04
POCP	[kg ethene-eq.]	3,84E-04	-5,88E-05	-5,79E-05	7,21E-05
ADPE	[kg Sb-eq.]	3,52E-04	5,22E-09	5,14E-09	5,44E-08
ADPF	[MJ]	2,86E+01	8,89E-01	8,75E-01	2,00E+00
Caption	GWP = Global warming potential; ODP = Ozone depletion potential; AP = Acidification potential; EP = Eutrophication potential; POCP = Photochemical ozone creation potential; ADPE = Abiotic depletion potential for non fossil resources; ADPF = Abiotic depletion potential for fossil resources				

RESOURCE USE					
Parameter	**Unit**	**A1-3**	**A4**	**C2**	**C4**
PERE	[MJ]	1,12E+01	4,48E-02	4,41E-02	2,42E-01
PERM	[MJ]	3,20E-01	0,00E+00	0,00E+00	0,00E+00
PERT	[MJ]	1,12E+01	4,48E-02	4,41E-02	2,42E-01
PENRE	[MJ]	2,89E+01	8,92E-01	8,78E-01	2,07E+00
PENRM	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PENRT	[MJ]	2,89E+01	8,92E-01	8,78E-01	2,07E+00
SM	[kg]	3,20E-01	0,00E+00	0,00E+00	0,00E+00
RSF	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00
NRSF	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00
FW	[m^3]	9,92E-03	8,29E-05	8,16E-05	3,94E-04
Caption	PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non renewable primary energy excluding non renewable primary energy resources used as raw materials; PENRM = Use of non renewable primary energy resources used as raw materials, PENRT = Total use of non renewable primary energy resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non renewable secondary fuels; FW = Use of net fresh water				

OUTPUT FLOWS AND WASTE CATEGORIES					
Parameter	**Unit**	**A1-3**	**A4**	**C2**	**C4**
HWD	[kg]	6,60E-04	4,68E-08	4,61E-08	3,28E-08
NHWD	[kg]	4,34E-01	6,82E-05	6,71E-05	9,62E+00
RWD	[kg]	1,24E-04	1,22E-06	1,20E-06	2,80E-05
CRU	[kg]	0,00E+00	0,00E+00	0,00E+00	0,00E+00
MFR	[kg]	7,00E-03	0,00E+00	0,00E+00	0,00E+00
MER	[kg]	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EEE	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EET	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Caption	HWD = Hazardous waste disposed; NHWD = Non hazardous waste disposed; RWD = Radioactive waste disposed; CRU = Components for re-use; MFR = Materials for recycling; MER = Materials for energy recovery; EEE = Exported electrical energy; EET = Exported thermal energy				

Life Cycle Assessment and Life Cycle Inventory Results of the plasterboard Yangına Dayanıklı Alçıpan® (FR)

Suya ve Yangına Dayanıklı Alçıpan® (WRFR)

ENVIRONMENTAL IMPACTS					
Parameter	**Unit**	**A1-3**	**A4**	**C2**	**C4**
GWP	[kg CO_2-eq.]	2,02E+00	6,49E-02	6,39E-02	1,54E-01
ODP	[kg CFC11-eq.]	4,90E-12	2,16E-14	2,13E-14	1,46E-13
AP	[kg SO_2-eq.]	5,37E-03	1,70E-04	1,67E-04	9,16E-04
EP	[kg PO_4^{3-}-eq.]	8,91E-04	4,11E-05	4,04E-05	1,25E-04
POCP	[kg ethene-eq.]	4,10E-04	-5,88E-05	-5,79E-05	7,21E-05
ADPE	[kg Sb-eq.]	3,63E-04	5,22E-09	5,14E-09	5,44E-08
ADPF	[MJ]	2,98E+01	8,89E-01	8,75E-01	2,00E+00
Caption	GWP = Global warming potential; ODP = Ozone depletion potential; AP = Acidification potential; EP = Eutrophication potential; POCP = Photochemical ozone creation potential; ADPE = Abiotic depletion potential for non fossil resources; ADPF = Abiotic depletion potential for fossil resources				

RESOURCE USE					
Parameter	**Unit**	**A1-3**	**A4**	**C2**	**C4**
PERE	[MJ]	1,15E+01	4,48E-02	4,41E-02	2,42E-01
PERM	[MJ]	3,20E-01	0,00E+00	0,00E+00	0,00E+00
PERT	[MJ]	1,19E+01	4,48E-02	4,41E-02	2,42E-01
PENRE	[MJ]	3,03E+01	8,92E-01	8,78E-01	2,07E+00
PENRM	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PENRT	[MJ]	3,03E+01	8,92E-01	8,78E-01	2,07E+00
SM	[kg]	7,00E-03	0,00E+00	0,00E+00	0,00E+00
RSF	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00
NRSF	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00
FW	[m^3]	6,13E-05	1,67E-07	1,64E-07	2,77E-06
Caption	PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non renewable primary energy excluding non renewable primary energy resources used as raw materials; PENRM = Use of non renewable primary energy resources used as raw materials, PENRT = Total use of non renewable primary energy resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non renewable secondary fuels; FW = Use of net fresh water				

OUTPUT FLOWS AND WASTE CATEGORIES					
Parameter	**Unit**	**A1-3**	**A4**	**C2**	**C4**
HWD	[kg]	6,60E-04	3,77E-08	3,77E-08	3,77E-08
NHWD	[kg]	5,83E-01	6,82E-05	6,71E-05	9,62E+00
RWD	[kg]	1,78E-04	1,22E-06	1,20E-06	2,80E-05
CRU	[kg]	0,00E+00	0,00E+00	0,00E+00	0,00E+00
MFR	[kg]	7,00E-03	0,00E+00	0,00E+00	0,00E+00
MER	[kg]	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EEE	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EET	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Caption	HWD = Hazardous waste disposed; NHWD = Non hazardous waste disposed; RWD = Radioactive waste disposed; CRU = Components for re-use; MFR = Materials for recycling; MER = Materials for energy recovery; EEE = Exported electrical energy; EET = Exported thermal energy				

Life Cycle Assessment and Life Cycle Inventory Results of the plasterboard Suya ve Yangına Dayanıklı Alçıpan® (WRFR)

Mouldboard® (MWR)

ENVIRONMENTAL IMPACTS					
Parameter	**Unit**	**A1-3**	**A4**	**C2**	**C4**
GWP	[kg CO_2-eq.]	2,45E+00	7,09E-02	6,99E-02	1,69E-01
ODP	[kg CFC11-eq.]	8,00E-12	2,36E-14	2,32E-14	1,60E-13
AP	[kg SO_2-eq.]	6,11E-03	1,86E-04	1,83E-04	1,00E-03
EP	[kg PO_4^{3-}-eq.]	1,01E-03	4,49E-05	4,42E-05	1,37E-04
POCP	[kg ethene-eq.]	5,16E-04	-6,42E-05	-6,33E-05	7,88E-05
ADPE	[kg Sb-eq.]	4,09E-04	5,70E-09	5,62E-09	5,95E-08
ADPF	[MJ]	3,62E+01	9,71E-01	9,57E-01	2,19E+00
Caption	GWP = Global warming potential; ODP = Ozone depletion potential; AP = Acidification potential; EP = Eutrophication potential; POCP = Photochemical ozone creation potential; ADPE = Abiotic depletion potential for non fossil resources; ADPF = Abiotic depletion potential for fossil resources				

RESOURCE USE					
Parameter	**Unit**	**A1-3**	**A4**	**C2**	**C4**
PERE	[MJ]	1,28E+01	4,89E-02	4,82E-02	2,65E-01
PERM	[MJ]	3,20E-01	0,00E+00	0,00E+00	0,00E+00
PERT	[MJ]	1,31E+01	4,89E-02	4,82E-02	2,65E-01
PENRE	[MJ]	3,71E+01	9,74E-01	9,60E-01	2,27E+00
PENRM	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PENRT	[MJ]	3,71E+01	9,74E-01	9,60E-01	2,27E+00
SM	[kg]	3,30E-01	0,00E+00	0,00E+00	0,00E+00
RSF	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00
NRSF	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00
FW	[m^3]	1,46E-02	9,05E-05	8,92E-05	4,31E-04
Caption	PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non renewable primary energy excluding non renewable primary energy resources used as raw materials; PENRM = Use of non renewable primary energy resources used as raw materials, PENRT = Total use of non renewable primary energy resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non renewable secondary fuels; FW = Use of net fresh water				

OUTPUT FLOWS AND WASTE CATEGORIES					
Parameter	**Unit**	**A1-3**	**A4**	**C2**	**C4**
HWD	[kg]	6,60E-04	5,12E-08	5,04E-08	3,59E-08
NHWD	[kg]	6,99E-01	7,45E-05	7,34E-05	1,05E+01
RWD	[kg]	3,45E-04	1,33E-06	1,31E-06	3,06E-05
CRU	[kg]	0,00E+00	0,00E+00	0,00E+00	0,00E+00
MFR	[kg]	7,00E-03	0,00E+00	0,00E+00	0,00E+00
MER	[kg]	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EEE	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EET	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Caption	HWD = Hazardous waste disposed; NHWD = Non hazardous waste disposed; RWD = Radioactive waste disposed; CRU = Components for re-use; MFR = Materials for recycling; MER = Materials for energy recovery; EEE = Exported electrical energy; EET = Exported thermal energy				

Life Cycle Assessment and Life Cycle Inventory Results of the plasterboard Mouldboard® (MWR)

Mouldboard® (MWFR)

ENVIRONMENTAL IMPACTS					
Parameter	**Unit**	**A1-3**	**A4**	**C2**	**C4**
GWP	[kg CO_2-eq.]	2,54E+00	7,09E-02	6,99E-02	1,69E-01
ODP	[kg CFC11-eq.]	8,15E-12	2,36E-14	2,32E-14	1,60E-13
AP	[kg SO_2-eq.]	6,60E-03	1,86E-04	1,83E-04	1,00E-03
EP	[kg PO_4^{3-}-eq.]	1,04E-03	4,49E-05	4,42E-05	1,37E-04
POCP	[kg ethene-eq.]	5,40E-04	-6,42E-05	-6,33E-05	7,88E-05
ADPE	[kg Sb-eq.]	4,13E-04	5,70E-09	5,62E-09	5,95E-08
ADPF	[MJ]	3,73E+01	9,71E-01	9,57E-01	2,19E+00
Caption	GWP = Global warming potential; ODP = Ozone depletion potential; AP = Acidification potential; EP = Eutrophication potential; POCP = Photochemical ozone creation potential; ADPE = Abiotic depletion potential for non fossil resources; ADPF = Abiotic depletion potential for fossil resources				

RESOURCE USE					
Parameter	**Unit**	**A1-3**	**A4**	**C2**	**C4**
PERE	[MJ]	1,30E+01	4,89E-02	4,82E-02	2,65E-01
PERM	[MJ]	3,20E-01	0,00E+00	0,00E+00	0,00E+00
PERT	[MJ]	1,33E+01	4,89E-02	4,82E-02	2,65E-01
PENRE	[MJ]	3,82E+01	9,74E-01	9,60E-01	2,27E+00
PENRM	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PENRT	[MJ]	3,82E+01	9,74E-01	9,60E-01	2,27E+00
SM	[kg]	3,30E-01	0,00E+00	0,00E+00	0,00E+00
RSF	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00
NRSF	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00
FW	[m^3]	1,49E-02	9,05E-05	8,92E-05	4,31E-04
Caption	PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non renewable primary energy excluding non renewable primary energy resources used as raw materials; PENRM = Use of non renewable primary energy resources used as raw materials, PENRT = Total use of non renewable primary energy resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non renewable secondary fuels; FW = Use of net fresh water				

OUTPUT FLOWS AND WASTE CATEGORIES					
Parameter	**Unit**	**A1-3**	**A4**	**C2**	**C4**
HWD	[kg]	6,60E-04	5,12E-08	5,04E-08	3,59E-08
NHWD	[kg]	7,08E-01	7,45E-05	7,34E-05	1,05E+01
RWD	[kg]	3,83E-04	1,33E-06	1,31E-06	3,06E-05
CRU	[kg]	0,00E+00	0,00E+00	0,00E+00	0,00E+00
MFR	[kg]	7,00E-03	0,00E+00	0,00E+00	0,00E+00
MER	[kg]	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EEE	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EET	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Caption	HWD = Hazardous waste disposed; NHWD = Non hazardous waste disposed; RWD = Radioactive waste disposed; CRU = Components for re-use; MFR = Materials for recycling; MER = Materials for energy recovery; EEE = Exported electrical energy; EET = Exported thermal energy				

Life Cycle Assessment and Life Cycle Inventory Results of the plasterboard Mouldboard® (MWFR)

Diamant®

ENVIRONMENTAL IMPACTS					
Parameter	**Unit**	**A1-3**	**A4**	**C2**	**C4**
GWP	[kg CO_2-eq.]	2,42E+00	8,62E-02	8,52E-02	2,06E-01
ODP	[kg CFC11-eq.]	5,00E-12	2,87E-14	2,83E-14	1,95E-13
AP	[kg SO_2-eq.]	6,56E-03	2,26E-04	2,23E-04	1,22E-03
EP	[kg PO_4^{3-}-eq.]	1,11E-03	5,45E-05	5,39E-05	1,66E-04
POCP	[kg ethene-eq.]	4,86E-04	-7,81E-05	-7,72E-05	9,61E-05
ADPE	[kg Sb-eq.]	4,22E-04	6,94E-09	6,85E-09	7,26E-08
ADPF	[MJ]	3,55E+01	1,18E+00	1,17E+00	2,67E+00
Caption	GWP = Global warming potential; ODP = Ozone depletion potential; AP = Acidification potential; EP = Eutrophication potential; POCP = Photochemical ozone creation potential; ADPE = Abiotic depletion potential for non fossil resources; ADPF = Abiotic depletion potential for fossil resources				

RESOURCE USE					
Parameter	**Unit**	**A1-3**	**A4**	**C2**	**C4**
PERE	[MJ]	1,30E+01	4,89E-02	4,82E-02	2,65E-01
PERM	[MJ]	3,20E-01	0,00E+00	0,00E+00	0,00E+00
PERT	[MJ]	1,33E+01	4,89E-02	4,82E-02	2,65E-01
PENRE	[MJ]	3,82E+01	9,74E-01	9,60E-01	2,27E+00
PENRM	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PENRT	[MJ]	3,82E+01	9,74E-01	9,60E-01	2,27E+00
SM	[kg]	3,30E-01	0,00E+00	0,00E+00	0,00E+00
RSF	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00
NRSF	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00
FW	[m^3]	1,49E-02	9,05E-05	8,92E-05	4,31E-04
Caption	PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non renewable primary energy excluding non renewable primary energy resources used as raw materials; PENRM = Use of non renewable primary energy resources used as raw materials, PENRT = Total use of non renewable primary energy resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non renewable secondary fuels; FW = Use of net fresh water				

OUTPUT FLOWS AND WASTE CATEGORIES					
Parameter	**Unit**	**A1-3**	**A4**	**C2**	**C4**
HWD	[kg]	6,60E-04	5,12E-08	5,04E-08	3,59E-08
NHWD	[kg]	7,08E-01	7,45E-05	7,34E-05	1,05E+01
RWD	[kg]	3,83E-04	1,33E-06	1,31E-06	3,06E-05
CRU	[kg]	0,00E+00	0,00E+00	0,00E+00	0,00E+00
MFR	[kg]	7,00E-03	0,00E+00	0,00E+00	0,00E+00
MER	[kg]	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EEE	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EET	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Caption	HWD = Hazardous waste disposed; NHWD = Non hazardous waste disposed; RWD = Radioactive waste disposed; CRU = Components for re-use; MFR = Materials for recycling; MER = Materials for energy recovery; EEE = Exported electrical energy; EET = Exported thermal energy				

Life Cycle Assessment and Life Cycle Inventory Results of the plasterboard Diamant®

Relative contributions of products against Flex Alçıpan® (FX) which has the lowest value in each impact category.

Interpretation of the Results

For almost all of the indicators described, a strong dominance of the production stage modules A1-A3 is recognized. The emphasis within the Modules A1-A3 generally lies on the production of the boards.

The modules A4 and C2 provide just little contribution to the effective indicators. Due to the assumed transport distance of 100 km in each case and the similar transport weight related to the declared unit, very similar contributions result in A4 and C2 beyond all effective indicators. The disposal of the plasterboards in C4 shows rather little contributions in most indicators. Positive contributions on photochemical oxidation potential (POCP) impact is due to the way the effects of NO and NOx is treated in CML methodology. Reaction of NO with O3 reduces its amount and its oxidation potential.

Impact categories for the life cycle acc. to the considered modules (Flex Alçıpan® (FX))

Programme-related Information and Verification

The EPD® owner has the sole ownership, liability, and responsibility for the EPD®. EPD®s within the same product category but from different programmes may not be comparable. EPD®s of construction products may not be comparable if they do not comply with EN 15804.

Programme:	EPD® Turkey, a fully aligned regional programme EPD® Turkey: SÜRATAM – Turkish Centre for Sustainable Production Research & Design Nef 09 B Blok No:7/15, 34415 Kağıthane, İstanbul / TURKEY www.epdturkey.org The International EPD® System EPD® International AB Box 210 60 SE-100 31 Stockholm, Sweden www.environdec.com
Product Category Rules:	PCR 2012:01. Construction Products and Construction Services. Version 2.2
Product group classification:	UN CPC 37520
Reference year for data:	2017
Geographical scope:	Global

CEN standard EN 15804 serves as the Core Product Category Rules (PCR)
Product category rules (PCR): PCR 2012:01. Construction Products and Construction Services. Version 2.2
PCR review was conducted by: The Technical Committee on the International EPD® System, Martin Erlandsson, IVL Swedish Enviromental Research Institute
Independent third-party verification of the declaration and data, according to ISO 14025:2006: ☐ EPD® process certification ☒ EPD® verification
3rd party verifier: Dr. Hüdai Kara, Metsims Sustainability Consulting www.metsims.com
Approved by: The International EPD® System
Procedure for follow-up of data during EPD® validity involves third party verifier: ☐ Yes ☒ No

References

1 **EN 15804**, EN 15804:2012-04: Sustainability of construction works – Environmental Product Declarations – Core rules for the product category of construction products.

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ENVIRONMENTAL PRODUCT DECLARATION

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