ENVIRONMENTAL PRODUCT DECLARATION

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

Owner of the Declaration	FDT Flachdach Technologie GmbH
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-FDT-20240156-IBA1-EN
Issue date	23.08.2024
Valid to	22.08.2029

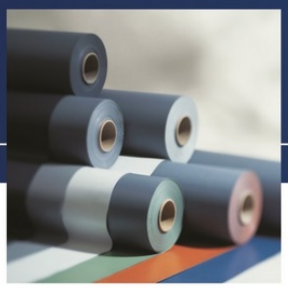
Rhenofol CV, Rhenofol CG

FDT Flachdach Technologie GmbH

Institut Bauen und Umwelt e.V.

www.ibu-epd.com | https://epd-online.com

ECO PLATFORM EPD VERIFIED



1. General Information

FDT Flachdach Technologie GmbH

Programme holder

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

Declaration number

EPD-FDT-20240156-IBA1-EN

This declaration is based on the product category rules:

Plastic and elastomer roofing and sealing sheet systems, 01.08.2021
(PCR checked and approved by the SVR)

Issue date

23.08.2024

Valid to

22.08.2029

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

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

Rhenofol CV, Rhenofol CG

Owner of the declaration

FDT Flachdach Technologie GmbH
Eisenbahnstr. 6-8
68199 Mannheim
Germany

Declared product / declared unit

1 m² produced Rhenofol CV and Rhenofol CG roofing membrane system (1.5 mm thick)

Scope:

This Environmental Product Declaration refers to the following products manufactured by FDT Flachdach Technologie GmbH at its Mannheim plant:

Rhenofol CG 1.2 mm / 1.5 mm / 1.8 mm / 2.0 mm
Rhenofol CV 1.2 mm / 1.5 mm / 1.8 mm / 2.0 mm

The LCA results listed in this EPD represent an average of the two products Rhenofol CV and Rhenofol CG, and refer to a thickness of 1.5 mm. Averaging is based on the corresponding production volumes (by area produced).

The EPD covers the production of the roofing membrane, the transport of the product to the construction site, the installation of the roofing membrane, the incineration, and the ensuing benefits for the next product system.

The LCA results listed in this EPD refer to a thickness of 1.5 mm. Using the formula in Section 5, all results can be converted to other thicknesses.

The owner of the declaration shall be liable for the underlying information and evidence; the IBU shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.

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

Verification

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

Matthias Schulz,
(Independent verifier)

2. Product

2.1 Product description/Product definition

Rhenofol CV and Rhenofol CG are multi-layer plastic roofing and waterproofing membranes based on polyvinyl chloride (PVC-P), available in various colours and designs:

Rhenofol CV:
Rhenofol CV (1.2 mm / 1.5 mm / 1.8 mm / 2.0 mm) has an internal layer of synthetic fibres as reinforcement (application type: DE/E1 PVC--P-NB--V--PG). Seams are joined by hot air or solvent welding agent.

Rhenofol CG:
Rhenofol CG (1.2 mm / 1.5 mm / 1.8 mm / 2.0 mm) has an internal layer of glass fleece as an insert (application type: DE/E1 PVC--P--NB--E--GV). Seams are joined by hot air or solvent welding agent.

The LCA results shown declare an average for the two products Rhenofol CV and Rhenofol CG. Averaging is based on the corresponding production volumes (by area produced).

The LCA results listed in this EPD refer to a thickness of 1.5 mm. Using the formula in Section 5, all results can be converted to other thicknesses.

(EU) Directive No. 305/2011 (CPR) applies for placing the product on the market in the EU/EFTA (with the exception of Switzerland). The product requires a Declaration of performance, taking consideration of *DIN EN 13956:2013*, Flexible sheets for waterproofing – Plastic and rubber sheets for roof waterproofing – Definitions and characteristics, or *DIN EN 13967:2012*, Flexible sheets for waterproofing – Plastic and rubber damp-proof sheets including plastic and rubber basement tanking sheet – Definitions and characteristics.

The respective national regulations apply for usage.

2.2 Application

Rhenofol CV is used for sealing purposes on flat and inclined roofs in mechanically-fastened layers.

Rhenofol CG is suitable for sealing green, gravel-ballasted or used roofs. The roofing membranes are also used as damp-proof sheets (type A) and as tanking sheets (type T).

The manufacturer's installation instructions must be observed during processing.

2.3 Technical Data

Rhenofol CV, Rhenofol CG

Name	Value	Unit
Water vapour diffusion resistance value µ, DIN EN 1931 (method B)	18.000 +/- 30%	
Tensile strength (Rhenofol CV), DIN EN 12311- 2 (method A)	≥ 1000	N/50 mm
Tensile strength (Rhenofol CG), DIN EN 12311- 2 (method B)	≥ 10	N/mm²
Tensile strain (Rhenofol CV), DIN EN 12311- 2 (method A)	≥ 15	%
Tensile strain (Rhenofol CG), DIN EN 12311- 2 (method B)	≥ 200	%
Seam peel resistance, DIN EN 12316-2	≥ 250	N/50 mm
Seam shear resistance (Rhenofol CV), DIN EN 12317-2	≥ 900	N/50 mm
Seam shear resistance (Rhenofol CG), DIN EN 12317-2	≥ 600	N/50 mm
Resistance to abrupt loads, rigid underlay / flexible underlay (Rhenofol CV 1.5 mm), DIN EN 12691	≥ 900	mm
Resistance to abrupt loads, rigid underlay / flexible underlay (Rhenofol CG 1.5 mm), DIN EN 12691	≥ 700	mm
Resistance to static loads, DIN EN 12730 (method A/B)	≥ 20	kg
Tear resistance (Rhenofol CV), DIN EN 12310-2	≥ 180	N
Tear resistance (Rhenofol CG),, DIN EN 12310-2	≥ 140	N
Tear resistance (nail tearing force) (Rhenofol CG), DIN EN 12310-1	≥ 150	N
Resistance to root penetration (Rhenofol CG), FLL, DIN EN 13948	Root- and rootstock-proof	
Dimensional stability after warm storage, DIN EN 1107-2	≤ 0,2	%
Folding at low temperatures, DIN EN 495-5	≤ -30	°C
Resistance to chemicals, DIN EN 1847	fulfilled	
UV radiation, DIN EN 1297	Class 0 (5,000 h)	h
Water tightness, DIN EN 1928 (method B)	≥ 400	kPa

The technical data of the product correspond to the values in the declaration of performance with regard to its essential characteristics, in accordance with *DIN EN 13956:2013* for Rhenofol CV and Rhenofol CG and *DIN EN 13967:2012* for Rhenofol CG.

2.4 Delivery status

Rhenofol CV:
20 m x 2.05 / 1.50 / 1.03 / 0.68 m x 1.2 mm
20 m x 1.50 m / 1.03 / 0.68 m x 1.5 mm
15 m x 2.05 m x 1.5 mm
15 m x 2.05 / 1.50 / 1.03 m x 1.8 mm
15 m x 1.5 m x 2.0 mm.

Rhenofol CG:
20 m x 2.05 m x 1.2 mm
15 m x 2.05 m x 1.5 mm
15 m x 2.05 m x 1.8 mm
15 m x 2.05 m x 2.0 mm

2.5 Base materials/Ancillary materials

Rhenofol CV and Rhenofol CG comprise:

- Polyvinyl chloride (PVC) 45--60%
- Plasticizers 30--40%
- Stabilising agents 1--3%
- Flame retardants 1--3%
- Dyes and additives 0--10%
- Carrier and reinforcement material 1--8%

1) The product contains substances from the *ECHA List* of Candidates of Substances of Very High Concern (SVHC) (dated 14 June 2023) exceeding 0.1% by mass: **no**

2) The product contains other *CMR substances* in categories 1A or 1B, which are not on the candidate list, exceeding 0.1% by mass in at least one partial product: **no**.

3) Biocide products were added to this construction product or it has been treated with biocide products (this then concerns a treated product as defined by the (EU) Ordinance on Biocide Products No. 528/2012): **yes**
Rhenofol CG contains DCOIT, an algicide.

2.6 Manufacture

The PVC mixture for Rhenofol CV and Rhenofol CG is produced via a dry blend. After homogenisation and jellifying in the heating mixer, the mixture is added to the cooling mixer from where it is plastified with an extruder and mixing roll and shaped as foil using calendar technology. A doubling calender is used to finish the roofing membrane with an internal reinforcement layer (Rhenofol CV) or an insert of glass fleece (Rhenofol CG).

Production is subject to continuous measurement of product quality as part of the implemented quality management system in accordance with *ISO 9001* and the energy management system in accordance with *ISO 50001*.
The certification agency is TÜV Süd Management Service.

Furthermore, external quality inspections (external monitoring) are carried out by an external, recognised state materials testing institute and further quality audits for export approvals.

2.7 Environment and health during manufacturing

1.1 In addition to national regulations, the following is used in the manufacture of Rhenofol CV and Rhenofol CG for environmentally-friendly production:

- An electric separator is used for waste air which achieves a high degree of waste air purity.
- The plant in Mannheim has an energy management system certified to *DIN 50 001*.
- Waste heat for heating and hot water is used in the energy-efficient production process.
- The production waste incurred is redirected to the production circuit in the form of in-company recycling.
- In order to ensure the health and safety of employees, workplace designs are continuously improved for the purpose of physical relief and optimised ergonomics and regular seminars are held on the topic of health and safety.

2.8 Product processing/Installation

Rhenofol CV and Rhenofol CG roofing membranes are rolled out on the roof and joined at the seams by hot air welding or solvent-welding agent (see Safety data sheet). No particular measures concerning health and safety are required when hot air welding on the roof.

Rhenofol CV is mechanically fastened. Rhenofol CG is laid loosely and ballasted, e.g. with gravel or tile surfaces and under green areas.

The manufacturer's installation instructions must be observed during processing. The current product data sheet must always be observed for each product (see website).

2.9 Packaging

The individually packaged rolls of Rhenofol roofing and waterproofing membranes are shipped on pallets. The core of the roll is made of recycled cardboard. A protective separating layer made of cardboard is between the Euro pallet and rolls and the top side of the rolls features an additional protective layer made of PP. The rolls are secured by wooden wedges. The loaded pallet is shrink-wrapped in PE stretch foil and bound by four plastic straps. If collected by type, the packaging materials can be recycled.

2.10 Condition of use

According to our many years of experience, the functionality and waterproofing function is maintained over a long period of time when installed professionally and used as intended. Irrespective of this, the roofing membrane is subject to natural ageing.

2.11 Environment and health during use

There are no indications of possible environmentally hazardous or harmful substance emissions during the utilisation phase of Rhenofol CV or Rhenofol CG.

2.12 Reference service life

The service life is basically dependent on the thickness of the web and environmental influences. Under normal conditions, correct installation and regular maintenance, empirical values indicate that Rhenofol CV and Rhenofol CG have a life cycle of 35 years and more; please refer to the attached BBA Agrément Certificate No. 98/3491.

2.13 Extraordinary effects

Fire

Rhenofol CV und Rhenofol CG

Name	Value
Reaction to fire tests, DIN EN ISO 11925-2; DIN EN 13501-1	Class E / passed
Performance in case of external fire exposure to roofs, DIN CEN/TS 1187	Broof (t1) / passed*)

*) Test results are available for Rhenofol CV in accordance with *CEN/TS 1187* for the roof structures tested by FDT. Rhenofol CG is not subject to any further fire protection requirements (roofs under ballast).

Water

Rhenofol CV and Rhenofol CG have no known effects on the environment through exposure to water.

Mechanical destruction

Rhenofol CV and Rhenofol CG synthetic sheets for waterproofing are highly resilient and robust. No environmental impacts are known in the event of unanticipated mechanical destruction.

2.14 Re-use phase

Rhenofol CV and Rhenofol CG can be recycled after the use phase. When separated by type, Rhenofol CV and Rhenofol CG can be directed to the 'ROOFCOLLECT' collection system (recycling system for synthetic roofing and waterproofing membrane systems) or another recycling system.

Thermal utilisation is also possible with the result that the energy contained in Rhenofol CV and Rhenofol CG is released and used during incineration. As a general rule, material recycling should take preference over incineration.

2.15 Disposal

The waste code numbers (*AVV*) for the two plastic waterproofing membranes Rhenofol CV and Rhenofol CG are as follows:

- 170904 (Mixed building and demolition rubble)
- 200139 (Plastics)

2.16 Further information

More information on Rhenofol CV and Rhenofol CG, such as brochures, data sheets, installation instructions, and technical manuals, can be found on the *website*.

3. LCA: Calculation rules

3.1 Declared Unit

The declared unit is 1 m² produced Rhenofol CV and Rhenofol CG roofing membrane with a sealing layer of 1.5 mm.

Declared unit

Name	Value	Unit
Declared unit	1	m^2
Grammage	1.94	kg/m^2
Type of sealing	Thermal welding	-
Thickness	1,5	mm
Layer thickness	0,0015	m

The LCA results listed in this EPD declare an average of the two products Rhenofol CV and Rhenofol CG and refer to a thickness of 1.5 mm. Averaging is based on the corresponding production volumes (by area produced). The results of Rhenofol CV 1.5 mm and Rhenofol CG 1.5 mm show a maximum difference of 5%.

The LCA results listed in this EPD refer to a thickness of 1.5 mm. Using the formula in Section 5, all results can be converted to other thicknesses.

3.2 System boundary

The EPD type is in accordance with *EN 15804+A2*. This is an EPD from the cradle to the factory gate with options, Modules C1-C4 and Module D (A1-A3 + C + D and additional Modules A4 and A5).

The individual life cycle stages are described below.

Modules A1-A3
The product stage comprises Modules A1 (production and upstream chains of the raw materials used), A2 (transport to the production site), and A3 (energy and waste flows and packaging materials).

Modules A4-A5
These modules include the transport to the construction site (A4) and utilisation of the packaging material (A5).

Module C1:
In this module, the manual dismantling of the roofing membranes is declared so that the associated environmental impacts are not relevant.

Module C2
This module declares the transport of the used roofing membranes for waste management at the end of product life.

Module C3
This module includes the thermal utilisation (100%) of the roofing membranes in a waste incineration plant (MVA) with an R1 value > 0.6.

Module C4
Landfilling is not of relevance for the roofing membranes.

Module D
The potential benefits for the next product system are declared in this module. In addition, potential credits from the utilisation of packaging from Module A5 are indicated.

3.3 Estimates and assumptions

Where no specific LCAFE processes were available, the individual recipe ingredients were estimated on the basis of information provided by the manufacturer or literary sources.

3.4 Cut-off criteria

The specific emissions associated with the provision of thermal and electric energy are taken into consideration in the upstream chains of energy provision. It can be assumed that additional emissions arising during manufacture are very low and therefore irrelevant. Assumptions were made as regards the transport expenses associated with all input and output data taken into consideration or the actual transport distances were applied. It can be assumed that the processes ignored would have contributed less than 5% to the impact categories under review. The manufacture of machinery, plants and other infrastructure required for production of the items under review was not taken into consideration in the LCA.

3.5 Background data

The primary data was provided by FDT Flachdach Technologie GmbH. The underlying data comes from the LCAFE software database from Sphera Solutions GmbH *LCAFE 2023*. The German green power mix was applied.

3.6 Data quality

The representativity can be classified as very good. Manufacturing of the synthetic roofing membrane systems was modelled using primary data from FDT Flachdach Technologie GmbH. All other relevant underlying data sets were taken from the *LCAFE CUP 2023.1* software database and are less than 7 years old.

3.7 Period under review

The data for this Life Cycle Analysis is based on data records from 2022. The volumes of raw materials, energy, ancillaries and consumables used are considered as average annual values in the Mannheim-Neckarau manufacturing plant.

3.8 Geographic Representativeness

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

3.9 Allocation

Production waste which is reused internally (edge trims in production) is modelled as closed-loop recycling in Modules A1-A3.

3.10 Comparability

Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to *EN 15804* and the building context, respectively the product-specific characteristics of performance, are taken into account. The *LCAFE software version CUP2023.1* underlying database was used.

4. LCA: Scenarios and additional technical information

Characteristic product properties of biogenic carbon

The product contains biogenic carbon.

Name	Value	Unit
Biogenic carbon content in product	0.033	kg C
Biogenic carbon content in accompanying packaging	0.0006	kg C

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

Transport to construction site (A4)

Name	Value	Unit
Litres of fuel	0.0018	l/100km
Transport distance	100	km
Capacity utilisation (including empty runs)	61	%

Construction installation process (A5)

The following packaging materials were declared for the analysis of 1 m2 roofing membrane:

Name	Value	Unit
Stretch foil, PE (packaging material)	5	g
Blanks, PP (packaging material)	2	g
Protective layer, cardboard (packaging material)	1	g
Output substances following waste treatment on site	0.008	kg

Reference Service Life

The reference service life is dependent on the thickness of the roofing and waterproofing membrane and possibly the surface protection (gravel, green roof) used. A weighted average was calculated. The service life is based on the company's experience.

Name	Value	Unit
Life Span acc. to manufacturer	35	a

End of Life (C1-C4)

Assumptions for the product end of life are as follows:

Name	Value	Unit
No power consumption – manual dismantling (C2)	0	kWh
Material loss through dismantling	0	%
Transport distance to EoL site (C2)	50	km
Energy recovery incineration	1.94	kg
To landfilling (C4)	0	kg

Reuse, recovery and recycling potential (D), relevant scenario details

Energy substitution and credits from A5 (packaging disposal) and C3 (incineration of the roofing membrane) are declared in Module D.

5. LCA: Results

The following table depicts the results for Rhenofol CV and Rhenofol CG 1.5 mm. The following formula can also be used to calculate other thicknesses:

$E_d = (0.6426d+0.0368)E_{1.5}$

E_d = result for the required thickness

d = required thickness

$E_{1.5}$ = result for 1.5 mm thickness

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

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

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT according to EN 15804+A2: 1 m2 1 m² Dachbahn Rhenofol CV/Rhenofol CG

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
GWP-total	kg CO_2 eq	4.87E+00	1.44E-02	2.41E-02	0	7.18E-03	4.62E+00	0	-2.06E+00
GWP-fossil	kg CO_2 eq	4.98E+00	1.42E-02	2.19E-02	0	7.12E-03	4.46E+00	0	-2.04E+00
GWP-biogenic	kg CO_2 eq	-1.1E-01	5.18E-05	2.27E-03	0	2.59E-05	1.57E-01	0	-1.85E-02
GWP-luluc	kg CO_2 eq	2.94E-03	8.53E-05	4.48E-08	0	4.26E-05	2.56E-05	0	-1.87E-04
ODP	kg CFC11 eq	4.63E-11	3.52E-15	2.34E-15	0	1.76E-15	7.03E-13	0	-2.5E-11
AP	mol H^+ eq	1.32E-02	1.2E-05	3.98E-06	0	6.01E-06	1.31E-03	0	-2.05E-03
EP-freshwater	kg P eq	5.99E-05	3.36E-08	5.8E-10	0	1.68E-08	1.96E-07	0	-5.54E-06
EP-marine	kg N eq	2.64E-03	3.44E-06	7.52E-07	0	1.72E-06	4.05E-04	0	-7.6E-04
EP-terrestrial	mol N eq	2.82E-02	4.39E-05	1.86E-05	0	2.19E-05	6.25E-03	0	-8.08E-03
POCP	kg NMVOC eq	1.3E-02	1.01E-05	2.01E-06	0	5.05E-06	1.05E-03	0	-1.95E-03
ADPE	kg Sb eq	8.4E-03	1.03E-09	1.75E-11	0	5.13E-10	5.28E-09	0	-1.78E-07
ADPF	MJ	1.13E+02	1.94E-01	3.94E-03	0	9.69E-02	1.17E+00	0	-3.17E+01
WDP	m^3 world eq deprived	7.19E-01	7.48E-05	2.25E-03	0	3.74E-05	4.55E-01	0	-2.7E-02

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

RESULTS OF THE LCA - INDICATORS TO DESCRIBE RESOURCE USE according to EN 15804+A2: 1 m2 1 m² Dachbahn Rhenofol CV/Rhenofol CG

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
PERE	MJ	2.21E+01	1.3E-02	2.72E-02	0	6.5E-03	1.79E+00	0	-1.22E+01
PERM	MJ	1.47E+00	0	-2.61E-02	0	0	-1.45E+00	0	0
PERT	MJ	2.36E+01	1.3E-02	1.14E-03	0	6.5E-03	3.45E-01	0	-1.22E+01
PENRE	MJ	7.19E+01	1.94E-01	3.24E-01	0	9.71E-02	4.18E+01	0	-3.17E+01
PENRM	MJ	4.1E+01	0	-3.2E-01	0	0	-4.07E+01	0	0
PENRT	MJ	1.13E+02	1.94E-01	3.94E-03	0	9.71E-02	1.17E+00	0	-3.17E+01
SM	kg	0	0	0	0	0	0	0	0
RSF	MJ	0	0	0	0	0	0	0	0
NRSF	MJ	0	0	0	0	0	0	0	0
FW	m^3	3.53E-02	1.16E-05	5.28E-05	0	5.78E-06	1.07E-02	0	-4.32E-03

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

RESULTS OF THE LCA – WASTE CATEGORIES AND OUTPUT FLOWS according to EN 15804+A2: 1 m2 1 m² Dachbahn Rhenofol CV/Rhenofol CG

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D

HWD	kg	1.05E-06	3.27E-13	5.61E-14	0	1.64E-13	1.85E-11	0	-1.9E-09
NHWD	kg	2.9E-01	2.91E-05	1.32E-04	0	1.45E-05	9.51E-02	0	-1.71E-02
RWD	kg	1.25E-03	2.56E-07	1.18E-07	0	1.28E-07	3.55E-05	0	-1.26E-03
CRU	kg	0	0	0	0	0	0	0	0
MFR	kg	0	0	0	0	0	0	0	0
MER	kg	0	0	0	0	0	0	0	0
EEE	MJ	0	0	4.23E-02	0	0	7.47E+00	0	0
EET	MJ	0	0	9.74E-02	0	0	1.71E+01	0	0

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

RESULTS OF THE LCA – additional impact categories according to EN 15804+A2-optional:
1 m2 1 m² Dachbahn Rhenofol CV/Rhenofol CG

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
PM	Disease incidence	5.28E-07	8.85E-11	2.44E-11	0	4.42E-11	7.15E-09	0	-1.5E-08
IR	kBq U235 eq	1.42E-01	2.74E-05	1.25E-05	0	1.37E-05	3.75E-03	0	-1.33E-01
ETP-fw	CTUe	4.71E+01	1.4E-01	1.52E-03	0	7E-02	4.22E-01	0	-5.42E+00
HTP-c	CTUh	1.77E-09	2.82E-12	1.64E-13	0	1.41E-12	4.72E-11	0	-3.86E-10
HTP-nc	CTUh	1.26E-07	1.41E-10	4.98E-12	0	7.05E-11	2.83E-09	0	-1.2E-08
SQP	SQP	3.77E+01	6.9E-02	1.23E-03	0	3.45E-02	3.51E-01	0	-8.44E+00

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

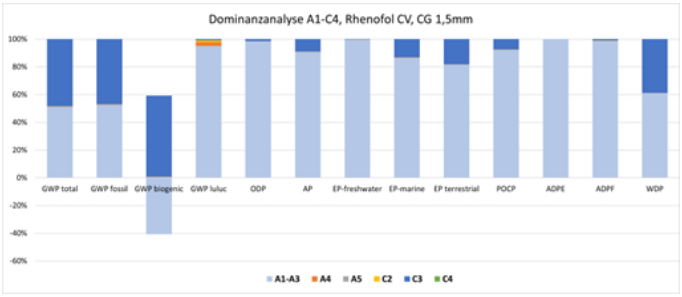
Limitation note 1 – applies for the indicator 'Potential impact of human exposure to U235': This impact category mainly addresses the potential impact of low-dose ionising radiation on human health in the nuclear fuel cycle. This does not consider impacts attributable to possible nuclear accidents and occupational exposure, nor to the disposal of radioactive waste in underground facilities. Potential ionising radiation from soil, radon and some building materials is also not measured by this indicator.

Limitation note 2 – applies for the indicators: 'Potential for abiotic resource depletion – non-fossil resources', 'Potential for abiotic resource depletion – fossil fuels', "Water depletion potential (users)', 'Potential ecosystem toxicity comparison unit', 'Potential human toxicity comparison unit – carcinogenic effect', 'Potential human toxicity comparison unit – non-carcinogenic effect', "Potential soil quality index'.

The results of this environmental impact indicator must be used with caution, as the uncertainties in these results are high or there is only limited experience with the indicator.

6. LCA: Interpretation

The following figure shows the effect of environmental influences based on Modules A1-C4 and allows the following interpretation for Rhenofol CV and Rhenofol CG 1.5 mm:



Modules A1-A3, product manufacturing, have a dominant influence on almost all of the indicators analysed. In the following, the environmental impact is first interpreted on the basis of global warming potential (GWP total) and the main influencing factors are identified.

Global warming potential (GWP total)
The total GWP of the declared product for Modules A1-C4 is mainly influenced by product manufacture (Modules A1-A3) (approx. 53%). The main factor here is the energy required to manufacture the raw materials and preliminary products (especially the polymers and plasticiser).
Transport to the customer (Module A4) has no major relevance in terms of GWP. Installation on the construction site (Module A5) contributes around <1% to the GWP total, while disposal transport (Module C2) only has a minor influence on the result. The energy recovery of the product and the associated emissions from the incineration plants (Module C3) contribute approx. 47% to the overall result.

Ozone depletion potential (ODP)
The ozone depletion potential of the declared product is mainly influenced by product manufacture (Modules A1-A3) (approx. 98%). As with the GWP total, the ozone depletion potential (ODP) is mainly caused by the provision of raw materials and the manufacturing process, while transport to the customer (Module A4), installation on the construction site (Module A5), and disposal transport (Module C2) have no major impact on the ODP. Energy recovery of the product (Module C3) makes a small contribution to ODP at approx. 2%.

In the case of the **POCP, AP** and **EP** indicators, the influence of energy recovery (Module C3) is increasing. This influence is around 10% for POCP, around 11% for AP, and 1 to 20% for EP.

Abiotic depletion of resources (ADP)
The ADP is determined at 98-99% by product manufacture (Modules A1-A3).

Water consumption (WDP)
The WDP of the declared product is mainly influenced by production (Modules A1-A3) (approx. 60%). Transport to the customer (Module A4) and installation on the construction site (Module A5) have no major effect on the WDP.

Disposal transport (Module C2) has almost no influence on the

result. Energy utilisation of the product as part of the incineration process (Module C3) makes a significant contribution to water consumption (approx. 40%).

7. Requisite evidence

No proof is required.

8. References

AVV: 2001-12
Ordinance on the List of Wastes dated 10 December 2001 (Federal Law Gazette No. I, p. 3379), last amended by Article 2 of the Ordinance dated 17 July 2017 (Federal Law Gazette No. I, p. 2644)

CPR (Construction Products Regulation)
Directive (EU) No. 305/2011 of the European Parliament and Council dated 9 March 2011 on specifying harmonised conditions for marketing building products (Construction Products Regulation)

DIN EN 495-5:2013--08
Flexible sheets for waterproofing – Determination of foldability at low temperature – Part 5: Plastic and rubber sheets for roof waterproofing

DIN EN 1107-2: 2001--04
Flexible sheets for waterproofing – Determination of dimensional stability – Part 2: Plastic and rubber sheets for roof waterproofing

DIN CEN TS 1187: 2012--03
Test methods for external fire exposure to roofs

DIN EN 1297: 2004--12
Flexible sheets for waterproofing – Plastic and rubber sheets for roof waterproofing – Method of artificial ageing by long-term exposure to the combination of UV radiation, elevated temperature and water

DIN EN 1847:2010-0-4
Flexible sheets for waterproofing – Plastics and rubber sheets for roof waterproofing – Methods for exposure to liquid chemicals, including water

DIN EN 1928:2000--07
Flexible sheets for waterproofing – Bitumen, plastic and rubber sheets for roof waterproofing – Determination of watertightness

DIN EN ISO 11925-2:2011-02
Reaction to fire tests – Ignitability of products subjected to direct impingement of flame

DIN EN 12310-2:2000--12
Flexible sheets for waterproofing – Determination of resistance to tearing – Part 2: Plastic and rubber sheets for roof waterproofing

DIN EN 12311-2:2013--11
Flexible sheets for waterproofing – Determination of tensile properties – Part 2: Plastic and rubber sheets for roof waterproofing

DIN EN 12316-2:2013--08
Flexible sheets for waterproofing – Determination of peel resistance of joints – Part 2: Plastic and rubber sheets for roof waterproofing

DIN EN 12317-2:2010-12
Flexible sheets for waterproofing – Determination of shear resistance of joints – Part 2: Plastic and rubber sheets for roof waterproofing

DIN EN 12691:2006--06
Flexible sheets for waterproofing – Bitumen, plastic and rubber sheets for roof waterproofing – Determination of resistance to impact

DIN EN 12703:2012--06
Adhesives for paper and board, packaging and disposable sanitary products – Determination of low temperature flexibility or cold crack temperature

DIN EN 13501-1:2010--01
Fire classification of construction products and building elements – Part 1: Classification using data from reaction to fire tests

DIN EN 13583:2012--10
Flexible sheets for waterproofing – Bitumen, plastic and rubber sheets for roof waterproofing – Determination of hail resistance

DIN EN 13948:2008--01
Flexible sheets for waterproofing – Bitumen, plastic and rubber sheets for roof waterproofing – Determination of resistance to root penetration

DIN EN 13956:2013--03
Flexible sheets for waterproofing – Plastic and rubber sheets for roof waterproofing – Definitions and characteristics

DIN EN 13967:2012+A1:2017
Flexible sheets for waterproofing – Plastic and rubber damp-proof sheets including plastic and rubber basement tanking sheet – Definitions and characteristics

DIN EN ISO 14025:2009--11
Environmental labels and declarations – Type III environmental declarations – Principles and procedures

DIN EN ISO 50001:2011--12
Environmental management systems – Requirements with guidance for use

DIN SPEC 20000-201:2018--08
Application of building products in structures – Part 201: Adaptation standard for flexible sheets for waterproofing according to European standards for use as waterproofing of roofs

DIN TS 20000-202:2020--11
Application of building products in structures – Part 202: Adaptation standard for flexible sheets for waterproofing according to European standards for use as waterproofing

EN 15804+A2:2019 + AC:2021
Sustainability of construction works – Environmental product declarations – Core rules for the product category of

construction products

EN 1931:2001-03
Flexible sheets for waterproofing – Bitumen, plastic and rubber sheets for roof waterproofing – Determination of water vapour transmission properties

FPC certificate
EC certificate of conformity of factory production control (FPC)

IBU, Part A
PCR – Part A: Calculation rules for the LCA and requirements on the Background Report, version 1.3, Institut Bauen und Umwelt e.V., www.bau-umwelt.com, 31.08.2022

ISO 9001:2015-11
Quality Management systems – Requirements

LCAFE
Sphera Solutions GmbH, LCAFE Software System and Database
CUP version: 2023.1, University of Stuttgart, Leinfelden Echterdingen

LCAFE database
LCAFE life cycle inventory data documentation (https://sphera.com/life-cycle-assessment-lca-software/)

PCR, Part B
PCR instructions for construction- related products and services in the construction products group pertaining to plastic and rubber roofing membrane systems, version 4, 19.10.2023

ECHA list; CMR substances, candidate list
See:
REACH: Regulation (EC) No. 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency

Website
www.FDT.de
The literature referred to in the Environmental Product Declaration must be listed in full.Standards already fully quoted in the EPD do not need to be listed here again.
The current version of PCR Part A and PCR Part B of the PCR document on which they are based must be referenced.

Publisher

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

+49 (0)30 3087748- 0
info@ibu-epd.com
www.ibu-epd.com

Programme holder

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

+49 (0)30 3087748- 0
info@ibu-epd.com
www.ibu-epd.com

Author of the Life Cycle Assessment

Sphera Solutions GmbH
Hauptstraße 111- 113
70771 Leinfelden-Echterdingen
Germany

+49 (0)711 341817-0
info@sphera.com
www.sphera.com

Owner of the Declaration

FDT Flachdach Technologie GmbH
Eisenbahnstr. 6-8
68199 Mannheim
Germany

0621-8504-100
kundensupport-ma@holcim.com
www.fdt.de