THE INTERNATIONAL EPD® SYSTEM

Environmental Product Declaration

In accordance with ISO 14025:2006 and EN 15804:2012+A2:2019/AC:2021 for:

Miralis Mineral Foam

From Miralis GmbH

Programme:	The International EPD® System, www.environdec.com
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An EPD should provide current information and may be updated if conditions change. The stated validity is therefore subject to the continued registration and publication at www.environdec.com

General information

Programme information

Programme:	The International EPD® System
Address:	EPD International AB Box 210 60 SE-100 31 Stockholm Sweden
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Accountabilities for PCR, LCA and independent, third-party verification

Product Category Rules (PCR)

CEN standard EN 15804 serves as the Core Product Category Rules (PCR)

Product Category Rules (PCR): PCR 2019:14-c-PCR-005 Thermal Insulation Products (EN 16783) (c-PCR to PCR 2019:14 Construction Products, version 1.3.4)

PCR review was conducted by the Technical Committee of the International EPD® System. A full list of members is available on www.environdec.com. The review panel may be contacted via info@environdec.com.

Life Cycle Assessment (LCA)

LCA accountability: DDI Dr. Matthias Katschnig, m.katschnig@oekobilanz.at, www.oekobilanz.at

Third-party verification

Independent third-party verification of the declaration and data, according to ISO 14025:2006:

Third-party verifier: Dr. Andreas Ciroth, GreenDelta GmbH

Approved by: The International EPD® System

The EPD owner has the sole ownership, liability, and responsibility for the EPD.

EPDs within the same product category but registered in different EPD programmes, or not compliant with EN 15804, may not be comparable. For two EPDs to be comparable, they must be based on the same PCR (including the same version number) or be based on fully-aligned PCRs or versions of PCRs; cover products with identical functions, technical performances and use (e.g. identical declared/functional units); have equivalent system boundaries and descriptions of data; apply equivalent data quality requirements, methods of data collection, and allocation methods; apply identical cut-off rules and impact assessment methods (including the same version of characterization factors); have equivalent content declarations; and be valid at the time of comparison. For further information about comparability, see EN 15804 and ISO 14025.

Company information

Owner of the EPD: Miralis GmbH

Contact: Miralis GmbH, Weba-Straße 15, 4407 Dietach, AUT, E-Mail: office@miralis.eco

Description of the organisation: Miralis GmbH, based in Austria, is a system provider for mineral insulation foams and was founded in 2006. It is part of Trivest AG, an international group of companies with innovative products and solutions. The Miralis headquarter is in Dietach near Steyr, including the competence center and production site. Miralis sees the challenge with insulation materials to provide materials that can be 100 % recycled, have a low CO_2 footprint, and at the same time meet the high requirements for insulation performance and fire safety. The recycling concepts must also be quick and easy to implement in practice. With Miralis Mineral Foam, a sustainable alternative has been created that not only offers high insulation performance and fire safety but also makes it very easy to recycle and reuse the material.

Product-related or management-system-related certifications: ISO 14067 PCF 2022

Name and location of production site: Miralis GmbH, Weba-Straße 15, 4407 Dietach, AUT

Product information

Product name: Miralis Mineral Foam, also known as “Miralis GMS65”

Product identification: Insulating material made from mineral resources

UN CPC code: 37990

Product description: Miralis Mineral Foam is a low-density, cement-based mineral foam. It is fire-resistant (A1) and hardens after just a few minutes. Depending on the application, the mineral foam can be sanded, cut, or covered with reinforcement in concrete walls. The plastic-free insulation material, which is approved in accordance with ETA-21/0753, is open to diffusion and its recyclability has been proven by the Montanuniversitaet Leoben, among others. The mineral foam is produced continuously or in batches in a physical foaming process. The foaming process takes place directly on site (Dietach) with a special Miralis foaming system. This EPD describes a mineral foam with a dry density of 60 kg/m^3.



LCA information

Study goal: The intended goal of this LCA is to create an EPD of Miralis Mineral Foam with a density of 60 kg/m^3, produced in 2024 as the main Miralis product. Mineral foam is used as insulation material in the construction sector. The intended application of the EPD is to provide environmental product information to the target group B2B. The EPD should be conducted according to EN 15804 and ISO 14025.

Type of EPD: specific EPD

Functional unit: The functional unit is 1 m^3 of dry mineral foam (dry density: 60 kg/m^3). The mineral foam has a thermal resistance RD of 28,6 (m^{2}K)/W (thermal conductivity λ_B: 0,035 W/mK). This corresponds to an insulation thickness of 1 m.

Reference service life: 50 years

Time representativeness: The data used for the LCA calculation refers to the year 2024.

Database and LCA software used: openLCA v2.4.1, ecoinvent v3.10 incl. en15804gd add-on from GreenDelta GmbH

System boundaries: cradle to gate with options, modules C1–C4 and module D and with optional modules (A1–A3, A5 + C + D)

Geographical scope: modules A1–A2: ITA, GER and AUT, module A3: GER, modules A4-A5: GER and AUT, module D: EU

Allocation: This EPD uses the cut-off principle. Production and cleaning losses from foam production, based on the production of one cubic meter of mineral foam in phase A5, are fed directly back into mineral foam production. Therefore, they do not require allocation as a closed-loop process. In the case of recycling, an additional 25 % of the recovered powdered mineral foam from the mono-fraction route to C4 is potentially fed back into the production of the functional unit (GeoBase) in A3 substituting primary raw material. As a closed-loop process, this also does not require any allocation. The benefit is that the waste replaces primary materials, and these are included accordingly in the life cycle inventory. The loads originate from processing the mono-fraction and transporting the light fraction from the processing site to the Miralis production site. There are no relevant co-products in modules A3 and A5. Loads due to energy, auxiliary, and operating materials are allocated 100 %

to the functional unit. In modules A3 and A5, 100 % of the charges and credits for the packaging and transportation material disposal are allocated to the functional unit. The loads from recycling in C4 are allocated 100 % to the functional unit.

Infrastructure/capital goods:

Infrastructure/capital goods are excluded from consideration in the LCA model.

Assumptions and waste scenarios:

For A1–A5: In A5, 100 % of the foam production waste generated from start-up and cleaning of the foaming system is fed back into the closed-loop production process as filter cake. Plastic and paper packaging waste that is generated and disposed of during production in A3 and A5 is treated as waste. The average truck transport route for plastic waste is around 300 km.

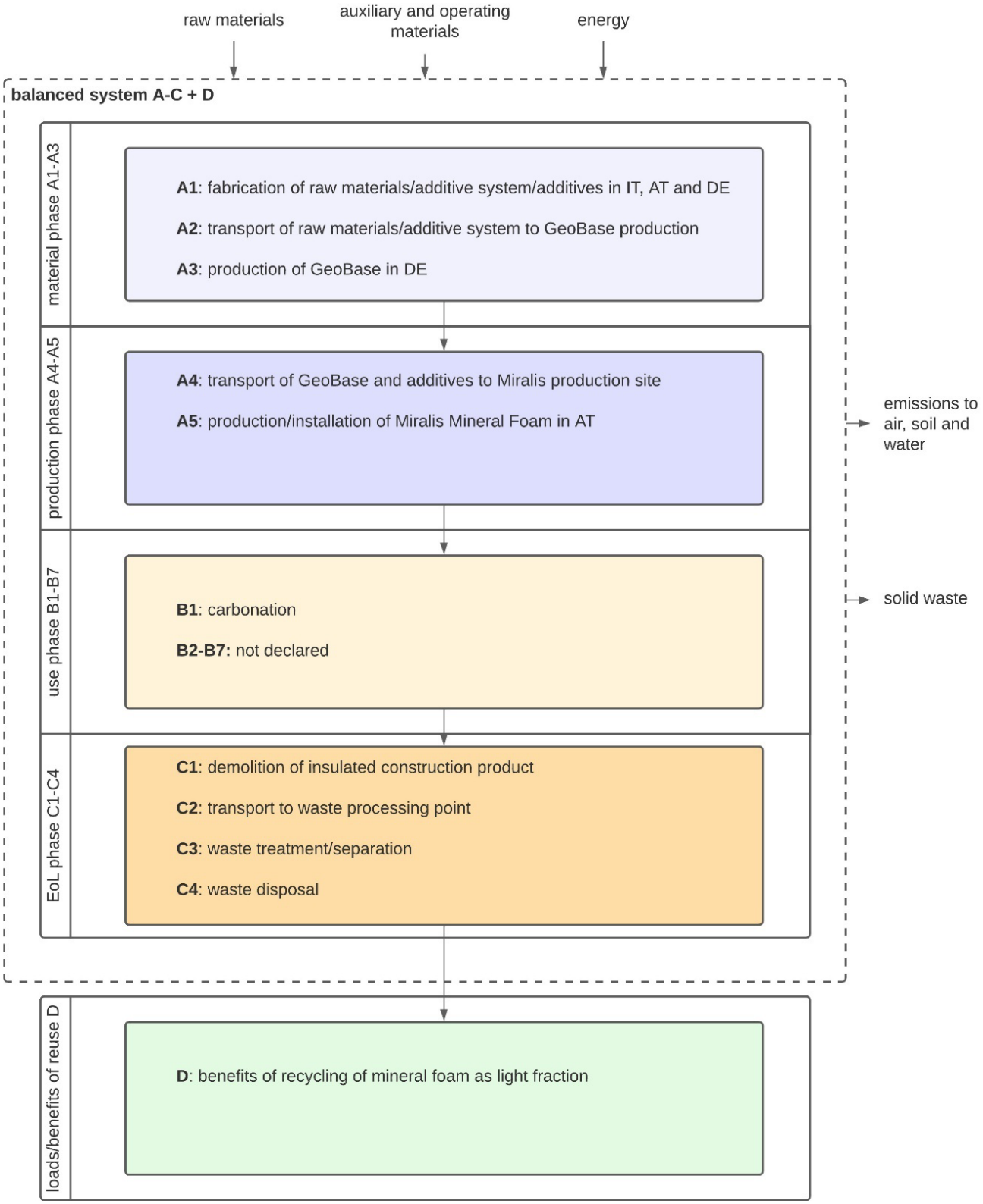
For B1–B7: The reference service life is 50 years. B1 includes carbonation. This is considered a CO_2 sink. The asymptote is set at approx. 5 % by weight of CO_2 uptake in relation to the functional unit (1). However, modules B2–B7 are not declared because of uncertain knowledge. Additionally, there are no material or mass flows for maintenance, repair, or any replacement or refurbishment work during the use phase. The input +/- output is thus equal to 0.

For C1–C4: In C1, the foam-insulated walls, bricks, or stones are expected to be demolished using chain excavators. Demolition is carried out on site using mobile crushers. The demolition material – if it is mixed construction waste – is then sorted, transported with wheeled excavators to module C3, where the waste will be processed directly on site using mobile crushing plants. Processing in C4: Pomberger et al (2) investigated a potential end-of-life scenario for mineral foam in the context of construction waste recycling. The mineral foam was separated from other construction waste in a suitable separation process (sieves etc.). It was separated into a light fraction (mineral foam) and a heavy fraction (concrete, lightweight concrete blocks or bricks). Processing and separation could be carried out adequately. Further tests at Miralis (3) also showed that the degree of separation and purity of the light fraction (recycled Miralis Mineral Foam) was sufficient for the substitution of primary GeoBase. Thus, the recycling scenario of the material flow through C4 is as follows: 25 % of the recovered Miralis Mineral Foam, which is available as a mono light fraction after special processing of the demolition mass (autogenous grinding and sieving), will be provided at the end of C4 to be fed back into GeoBase production in a closed loop and substitutes primary raw materials. The average distance from where the insulation material is used to the GeoBase processing and production site is assumed to be 270 km. The end-of-waste status is defined in accordance with EN 15804:2022 Annex B.1 (end-of-waste property) and is achieved after processing the light fraction in C4 before re-entering the product system in A3. 75 % of the recovered Miralis Mineral Foam will be landfilled (inert waste).

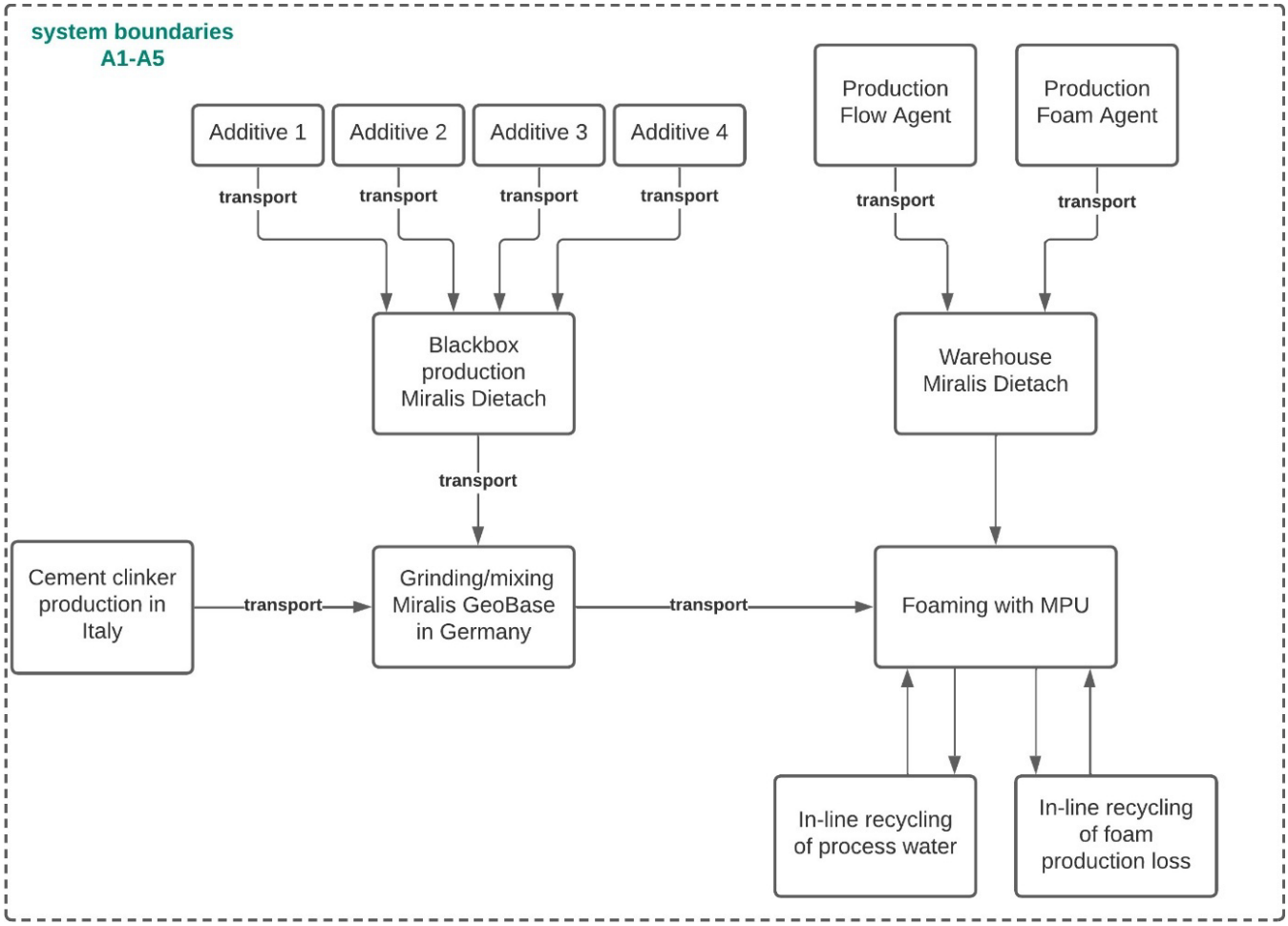
For D: Benefits and loads of raw material substitution of recycled mineral foam are accounted here.

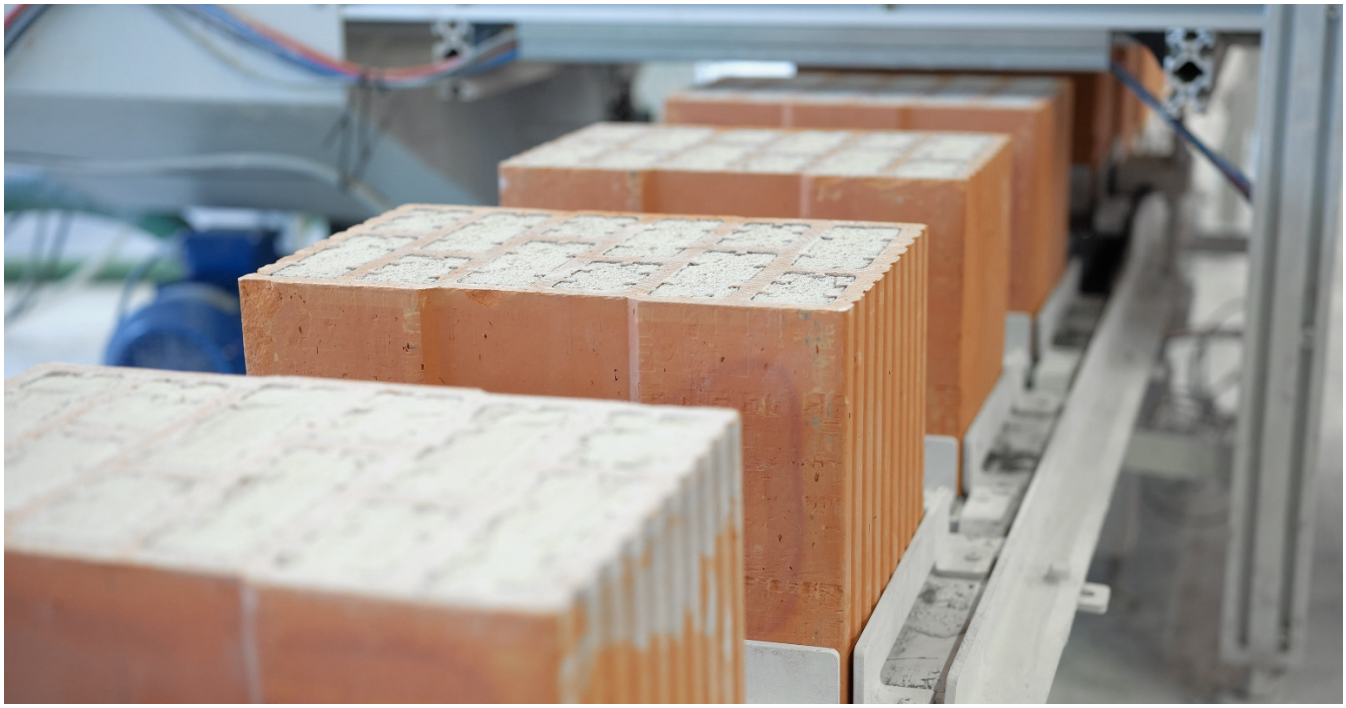
Cut-off rules: Considering all input and output data, it can be assumed that the sum of the neglected processes does not exceed the amount of 5 % of the characterization results of the individual impact categories. The cut-off criteria according to ÖN EN ISO 14044:2006 and ÖNORM EN 15804:2020 are therefore fulfilled.

System diagram:



Production flowchart:





Modules declared, geographical scope, share of specific data (in GWP-GHG results) and data variation (in GWP-GHG results):

	Product stage			Construction process stage		Use stage							End of life stage				Resource recovery stage
	Raw material supply	Transport	Manufacturing	Transport	Construction installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling- potential
Module	**A1**	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
Modules declared	X	X	X	X	X	X	ND	ND	ND	ND	ND	ND	X	X	X	X	X
Geography	ITA, GER, AUT	ITA, GER, AUT	GER	GER, AUT	AUT	AUT	ND	ND	ND	ND	ND	ND	EU	EU	EU	EU	DE, AT
Specific data used	> 90 %																-
Variation – products	-					-	-	-	-	-	-	-	-	-	-	-	-
Variation – sites	-					-	-	-	-	-	-	-	-	-	-	-	-

The transport material losses in A2 and A4, as well as the production losses in A3, are assumed to be below the 5 % cut-off. The transport losses in A1 are not declared because of a lack of data. Use stages B2–B7 are not declared due to inaccessible variance in use phases (for example differences in different construction buildings).

Using the results of modules A1–A5 without considering the results of module C is not recommended.

The following electricity inputs were modeled in A1–A5: Italy 729 g CO_2 eq/kWh (EPD-IES-0016451), Germany: 319 g CO_2 eq/kWh (GO, 2023), Austria: 219 g CO_2 eq/kWh (AT-Mix, 2023).

Content information

Product components	Weight, kg	Post-consumer material, weight-%	Biogenic material, weight, kg in FU
CSA clinker for GeoBase	45.00	-	-
Additive system for Mineral Foam (gypsum, anhydrite, OPC etc.)	13.88	-	-
Foaming aids (plasticizers, foaming agent)	1.12	-	-
TOTAL	60.00	-	-
Packaging materials	**Weight, kg**	**Weight-% (versus the product)**	**Weight biogenic carbon, kg C/kg**
Heavy duty paper	0.60	1	0.60
Polyethylene LD	0.12	0.2	-
Polyethylene HD	0.10	0.2	-
TOTAL	0.82	1.4	0.60

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

Dangerous substances from the candidate list of SVHC for Authorisation	EC No.	CAS No.	Weight-% per functional or declared unit
–	–	–	–

Results of the environmental performance indicators

Mandatory impact category indicators according to EN 15804

Results per functional unit										
Indicator	**Unit**	**A1-A3**	**A4**	**A5**	**B1**	**C1**	**C2**	**C3**	**C4**	**D**
GWP-fossil	kg CO_2 eq.	6,32E+01	8,88E+00	3,54E-01	0,00E+00	5,94E-01	1,15E+00	1,63E+01	4,49E+00	-4,68E+00
GWP-biogenic	kg CO_2 eq.	-2,32E+00	5,20E-03	2,53E-01	-3,00E+00	1,94E-04	1,24E-04	1,76E-03	2,50E-03	6,56E-01
GWP-luluc	kg CO_2 eq.	1,20E+00	2,80E-03	2,60E-04	0,00E+00	6,31E-05	9,87E-05	1,40E-03	1,47E-03	-2,92E-01
GWP-total	kg CO_2 eq.	6,20E+01	8,89E+00	6,07E-01	-3,00E+00	5,95E-01	1,15E+00	1,63E+01	4,49E+00	-4,31E+00
ODP	kg CFC 11 eq.	2,36E-06	1,77E-07	1,19E-09	0,00E+00	1,12E-08	1,74E-08	2,47E-07	9,22E-08	-7,76E-08
AP	mol H+ eq.	2,70E-01	1,74E-02	7,48E-04	0,00E+00	5,12E-03	3,89E-03	5,50E-02	1,03E-02	-2,97E-02
EP-freshwater	kg P eq.	1,34E-02	5,82E-04	1,71E-04	0,00E+00	2,57E-05	3,32E-05	4,71E-04	2,99E-04	-1,85E-03
EP-marine	kg N eq.	5,91E-02	4,11E-03	3,48E-04	0,00E+00	2,36E-03	1,58E-03	2,24E-02	2,71E-03	-1,21E-02
EP-terrestrial	mol N eq.	7,51E-01	4,44E-02	3,28E-03	0,00E+00	2,58E-02	1,74E-02	2,46E-01	2,93E-02	-6,70E-02
POCP	kg NMVOC eq.	2,05E-01	2,94E-02	1,11E-03	0,00E+00	7,87E-03	6,41E-03	8,71E-02	1,69E-02	-1,80E-02
ADP-minerals&metals*	kg Sb eq.	4,53E-04	2,92E-05	6,90E-07	0,00E+00	2,75E-07	4,17E-07	5,92E-06	1,43E-05	-9,99E-05
ADP-fossil*	MJ	6,21E+02	1,24E+02	2,22E+00	0,00E+00	7,66E+00	1,49E+01	2,11E+02	6,56E+01	-4,74E+01
WDP*	m3	1,77E+01	5,96E-01	1,96E-01	0,00E+00	2,76E-02	3,64E-02	5,16E-01	3,01E-01	-1,98E+00
Acronyms	GWP-fossil = Global Warming Potential fossil fuels; GWP-biogenic = Global Warming Potential biogenic; GWP-luluc = Global Warming Potential land use and land use change; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential, Accumulated Exceedance; EP-freshwater = Eutrophication potential, fraction of nutrients reaching freshwater end compartment; EP-marine = Eutrophication potential, fraction of nutrients reaching marine end compartment; EP-terrestrial = Eutrophication potential, Accumulated Exceedance; POCP = Formation potential of tropospheric ozone; ADP-minerals&metals = Abiotic depletion potential for non-fossil resources; ADP-fossil = Abiotic depletion for fossil resources potential; WDP = Water (user) deprivation potential, deprivation-weighted water consumption									

* Disclaimer: The results of this environmental impact indicator shall be used with care as the uncertainties of these results are high or as there is limited experience with the indicator.

Additional mandatory and voluntary impact category indicators

Results per functional or declared unit										
Indicator	**Unit**	**A1-A3**	**A4**	**A5**	**B1**	**C1**	**C2**	**C3**	**C4**	**D**
GWP-GHG[1]	kg CO_2 eq.	6,44E+01	8,88E+00	3,71E-01	0,00E+00	5,95E-01	1,15E+00	1,63E+01	4,49E+00	-4,98E+00

Resource use indicators

Results per functional or declared unit										
Indicator	**Unit**	**A1-A3**	**A4**	**A5**	**B1**	**C1**	**C2**	**C3**	**C4**	**D**
PERE	MJ	1,21E+02	2,40E+00	2,31E+00	0,00E+00	7,82E-02	9,13E-02	1,29E+00	1,20E+00	-1,69E+01
PERM	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT	MJ	1,21E+02	2,40E+00	2,31E+00	0,00E+00	7,82E-02	9,13E-02	1,29E+00	1,20E+00	-1,69E+01
PENRE	MJ	6,06E+02	1,12E+02	2,16E+00	0,00E+00	6,93E+00	1,34E+01	1,90E+02	5,95E+01	-4,55E+01
PENRM	MJ	1,66E+01	1,16E+01	5,97E-02	0,00E+00	7,30E-01	1,47E+00	2,08E+01	6,14E+00	-2,33E+00
PENRT	MJ	6,22E+02	1,24E+02	2,22E+00	0,00E+00	7,66E+00	1,49E+01	2,11E+02	6,56E+01	-4,78E+01
SM	kg	2,47E+01	1,57E-01	1,09E-01	0,00E+00	8,60E-03	8,80E-03	1,25E-01	7,77E-02	-1,75E-01
RSF	MJ	7,17E-01	5,21E-02	6,26E-02	0,00E+00	1,41E-03	1,04E-03	1,47E-02	2,53E-02	-1,14E-02
NRSF	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
FW	m3	4,45E-01	1,68E-02	8,80E-02	0,00E+00	5,82E-04	9,67E-04	1,37E-02	1,51E-02	-4,97E-02
Acronyms	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 re-sources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water									

Waste indicators

Results per functional or declared unit										
Indicator	**Unit**	**A1-A3**	**A4**	**A5**	**B1**	**C1**	**C2**	**C3**	**C4**	**D**
Hazardous waste disposed	kg	3,06E+00	1,10E-01	7,20E-03	0,00E+00	1,04E-02	1,29E-02	1,83E-01	5,70E-02	-7,02E-01
Non-hazardous waste disposed	kg	2,24E+01	1,39E+00	1,07E+00	0,00E+00	8,43E-02	9,66E-02	1,37E+00	7,32E-01	-4,65E+00
Radioactive waste disposed	kg	4,88E-04	4,75E-05	1,27E-05	0,00E+00	1,55E-06	1,63E-06	2,32E-05	2,36E-05	-8,06E-05

Output flow indicators

Results per functional or declared unit										
Indicator	**Unit**	**A1-A3**	**A4**	**A5**	**B1**	**C1**	**C2**	**C3**	**C4**	**D**
Components for re-use	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Material for recycling	kg	1,56E+00	1,41E-01	1,05E-01	0,00E+00	7,21E-03	7,26E-03	1,03E-01	6,93E-02	-9,61E-02
Materials for energy recovery	kg	3,22E-04	2,34E-05	2,81E-05	0,00E+00	6,33E-07	4,67E-07	6,62E-06	1,14E-05	-5,12E-06
Exported energy, electricity	MJ	2,15E-01	2,68E-02	1,88E-02	0,00E+00	8,03E-04	6,63E-04	9,41E-03	1,31E-02	-3,85E-02
Exported energy, thermal	MJ	5,08E-01	1,52E-01	-2,58E-03	0,00E+00	2,78E-04	3,52E-04	5,00E-03	7,22E-02	-8,05E-02

The estimated impact results are only relative statements, which do not indicate the endpoints of the impact categories, exceeding threshold values, safety margins, and/or risks.

[1] This indicator accounts for all greenhouse gases except biogenic carbon dioxide uptake and emissions and biogenic carbon stored in the product. As such, the indicator is identical to GWP-total except that the CF for biogenic CO_2 is set to zero.

References

General references:

General Programme Instructions of the International EPD® System. Version 4.0.

PCR 2019:14-c-PCR-005 Thermal Insulation products (EN 16783) (c-PCR to PCR 2019:14 Construction Products, version 1.3.4)

PCR 2019:14 Construction Products, version 1.3.4

ISO 14025:2006-07: Environmental labels and declarations - Type III environmental declarations - Principles and procedures

Specific references:

(1) C. Atzendorfer (2023): Quantitative Auswertung der Diffraktogramme von MIRALIS MINERAL FOAM auf Kalzitgehalt, Lehrstuhl für Gesteinshüttenkunde, Montanuniversität Leoben

(2) R. Pomberger, P. Sedlacek (2023): ReMiDäm 2 – Weiterführende Versuche zur technologischen Bewertung der Rezyklierbarkeit von mineralischen Dämmungen, Lehrstuhl für Abfallverwertungstechnik und Abfallwirtschaft, Montanuniversität Leoben

(3) M. Aigner (2023): Evaluierung von Verunreinigungen in sekundärem GMS, Miralis GmbH, Dietach