

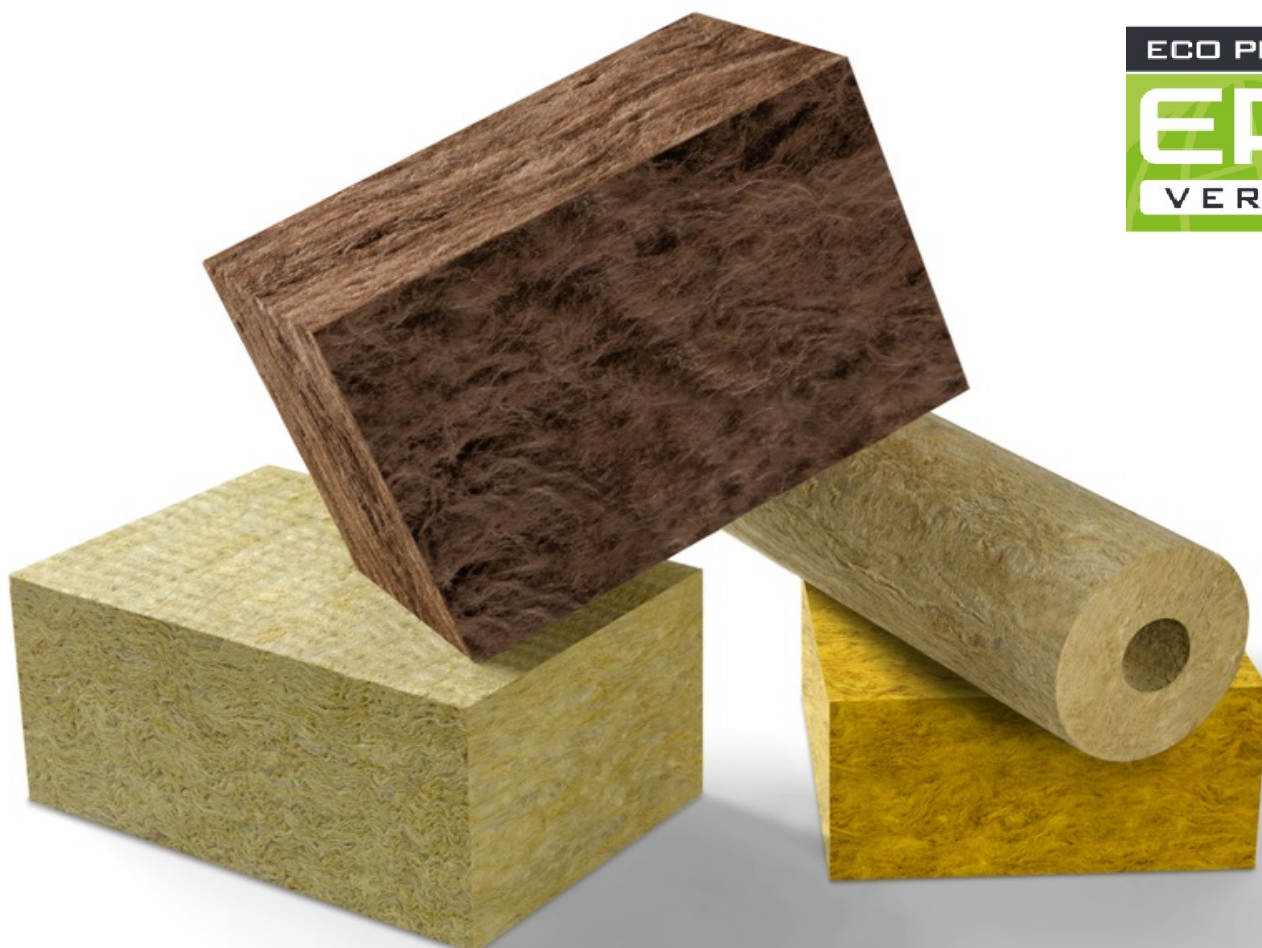
ENVIRONMENTAL-PRODUCT DECLARATION

as per ISO 14025 and EN 15804+A2

Owner of the Declaration	FMI Fachverband Mineralwolleindustrie e.V.
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-FMI-20210017-IBG1-EN
Issue date	29.06.2023
Valid to	28.06.2028

Mineral wool insulation (medium bulk density range)
FMI Fachverband Mineralwolleindustrie e.V.

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1. General Information

FMI Fachverband Mineralwolleindustrie e.V.

Programme holder

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

Declaration number

EPD-FMI-20210017-IBG1-EN

This declaration is based on the product category rules:

Mineral insulating materials, 01.08.2021
(PCR checked and approved by the SVR)

Issue date

29.06.2023

Valid to

28.06.2028



Dipl.-Ing. Hans Peters
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Mineral wool insulation (medium bulk density range)

Owner of the declaration

FMI Fachverband Mineralwolleindustrie e.V.
Friedrichstraße 95
10117 Berlin
Germany

Declared product / declared unit

This EPD describes the environmental impacts of 1 m³ unfaced or uncoated mineral wool insulation material (stone wool or glass wool) in the medium bulk density range from 60 to 120 kg/m³, with a declared bulk density of 100 kg/m³. In addition, the environmental impacts of three facings (glass veil, mineral coating and reinforced aluminium foil) based on 1 m² are listed in the appendix.

Scope:

This Environmental Product Declaration is a generic EPD of the FMI association. The life cycle assessment presented in the EPD refers to the life cycle of 1 m³ mineral wool in the medium bulk density range (60 to 120 kg/m³) of the following members of the Fachverband Mineralwolleindustrie e.V. (FMI):

- DEUTSCHE ROCKWOOL GmbH & Co. KG: Flechtingen, Gladbeck and Neuburg plants
- Knauf Insulation GmbH: Bernburg and St. Egidien plants
- SAINT-GOBAIN ISOVER G+H AG: Bergisch Gladbach, Ladenburg, Lüz and Speyer plants
- URSA Deutschland GmbH: Delitzsch plant

The data used cover 100 % of the annual production of the FMI members in Germany.

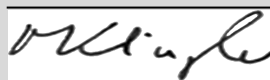
This EPD is mainly based on production data for the reference year 2019, collected in the plants and weighted by mass-based production volume. As a result of averaging, an average bulk density of 100 kg/m³ is obtained for mineral wool insulation materials in the medium bulk density range.

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 bezeichnet*.

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 Klingler,
(Independent verifier)

2. Product

2.1 Product description/Product definition

Mineral wool is the generic term for insulating materials made of glass wool and stone wool. These are non-combustible insulating materials, which consist mainly of amorphous fibres obtained from a silicate melt.

The mineral wool insulation materials described in this declaration are produced in the form of rolls, boards, mats, pipe sections as well as loose wool and blowing wool in the medium bulk density range (60 to 120 kg/m³). The ready-made products are supplied in thicknesses between 10 mm and 400 mm.

For certain applications, the insulation materials are provided with a functional facing on one or both sides. The environmental effects of the facings are shown in the appendix on the basis of 1 m².

For the placing on the market of the product in the European Union/European Free Trade Association (EU/EFTA) (with the exception of Switzerland) *Regulation (EU) No. 305/2011 (CPR)* applies. The products require a declaration of performance taking into account *EN 13162* (Thermal insulation products for buildings), *EN 14303* (Thermal insulation products for building equipment and industrial installations) or *EN 14064-1* (Thermal insulation products for buildings - In-situ formed loose-fill mineral wool (MW) products - Part 1: Specification for the loose-fill products before installation) in combination with *EAD 040729-00-1201* (Thermal insulation made of loose-fill mineral wool) and the CE marking. The respective national regulations apply to its use.

2.2 Application

Mineral wool insulation materials are used in buildings and industrial plants for thermal insulation as well as noise and fire protection. The main application areas of the products declared in this EPD are:

- All areas of application according to *DIN 4108-10* for wall, ceiling and roof applications with the specified requirements regarding thermal and sound insulation and the mechanical properties
- Blowing wool and loose-fill insulation
- Technical insulation and building services (e.g. insulation of pipes for ventilation, heating and hot water, district heating pipelines, boilers and equipment)
- Fire protection elements and industrial applications (e.g. air-conditioning ducts, fire protection doors, prefabricated components, chimney systems, cable penetration sealing)

2.3 Technical Data

Technical data

Name	Value	Unit
Declared value for thermal conductivity according to EN 13162 or EN 14064	0.030-0.045	W/(mK)
Calculation value for thermal conductivity according to DIN 4108-4	0.031 - 0.046	W/mK
For technical insulation data according to EN 14303	please refer to product data sheets	
For products with aluminium facing	please refer to EN 14303 and the manufacturers' product data sheets	
Water vapor diffusion equivalent air layer thickness	-	m
For products with aluminium facing	please refer to the manufacturers' product data sheets	
Continuous glowing combustion	does not show propensity for continuous smouldering according to EN 16733	
Sound absorption coefficient according to EN 13162 or EN 14303	please refer to the manufacturers' product data sheets	
Bulk density	60-120	kg/m ³
Compressive strength / compressive stress according to EN 13162 or EN 14303: please refer to the manufacturers' product data sheets	0-40	kPa
Formaldehyde emissions according to EN 16516	< 120	µg/m ³

For further technical data, please refer to the manufacturers' product data sheets.

Performance data of the product in accordance with the declaration of performance with respect to its essential characteristics according to:

- *EN 13162*, Thermal insulation products for buildings – Factory-made mineral wool (MW) products and *EN 14303*, Thermal insulation products for building equipment and industrial installations – Factory-made mineral wool (MW) products – Specification

- *EN 14064-1*, Thermal insulation products for buildings – In-situ formed loose-fill mineral wool (MW) products – Part 1: Specification for the loose-fill products before installation in combination with *EAD 040729-00-1201*, Thermal insulation made of loose-fill mineral wool

2.4 Delivery status

The mineral wool insulation materials described in this declaration are produced in various package sizes and dimensions, for example as boards, mats or rolls, in the medium bulk density range (60 to 120 kg/m³). The ready-made products are supplied in thicknesses between 10 mm and

400 mm. Details can be found in the manufacturers' delivery programs or can be obtained from the manufacturer.

2.5 Base materials/Ancillary materials

The composition of the raw materials and auxiliaries used depends on the manufacturer and product:

- **Stone wool** consists mainly of naturally occurring stones such as diabase, basalt, dolomite, phonolite (max. 50 mass %) and cement-bonded bricks (max. 100 mass %). The cement-bonded bricks contain cement, recycled stone wool waste (production residues, construction waste and demolition waste) and other (secondary) raw materials.

- The main raw materials for **glass wool** production are recycled glass (max. 80 mass %), dolomite, limestone (max. 20 mass %), sand (max. 20 mass %), soda (max. 15 mass %) and borates (max. 8 mass %) as well as recycled production residues.

The cross-linking of the fibres is achieved by using 2-8 % binder (mainly urea-modified phenol-formaldehyde resin or based on vegetable starch). Furthermore, small amounts (< 0.5 %) of mineral oil, adhesive agents and hydrophobic agents are used.

For the facings and coatings, textile glass fibres, binders, magnesium carbonate and aluminium foil are used as basic and auxiliary materials.

Recycled material can account for up to 80 % of the raw materials used. The average "recycled content" is:

- "Pre-consumer" (secondary materials without internal waste): 3 %
- "Post-consumer" (e.g. construction waste and demolition waste): 7 %

The product/article/at least one partial article contains substances listed in the *ECHA Candidate List* (status: 16.01.2020) exceeding 0.1 percentage by mass: no.

This product/article/at least one partial article contains other CMR substances in categories 1A or 1B which are not on the *ECHA Candidate List*, exceeding 0.1 percentage by mass: no.

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 *Biocidal Products Regulation*): no.

2.6 Manufacture

For production, the required quantities of the raw materials are weighed, mixed and fed into a melting furnace. The raw materials are melted in a furnace at temperatures of approx. 1,400-1,500 °C.

The manufacture of the fibres depends on the product. Three processes are used:

- **Rotary process** (mainly glass wool): After passing the melting furnace, a thin jet of glass is led into a rapidly rotating metal basket where it is ejected through thousands of small holes in the outer wall of the basket. The resulting filaments are drawn out into fibres using a gas burner and compressed air.

- **Cascade centrifugal process** (stone wool): After passing the cupola furnace, a thin jet of the liquid melt is directed onto rapidly rotating metal wheels. Their rotational movement spins the melt into fibres.

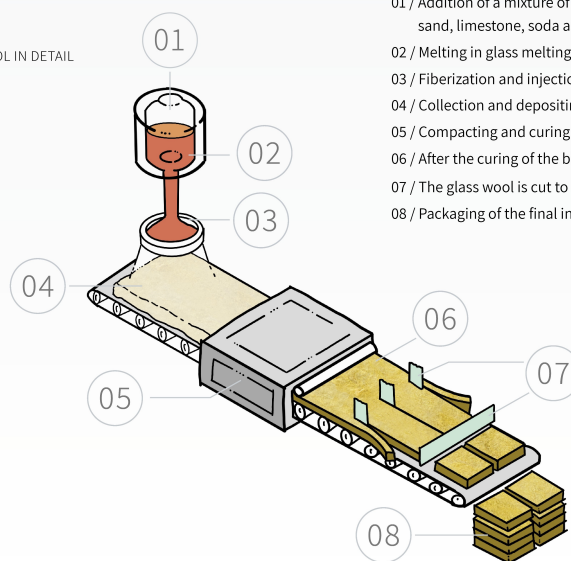
- **Steam-Blown process** (stone wool): After passing the melting furnace, the glass melt flows through many nozzles. The resulting filaments are drawn out into fibres by compressed air or high-pressure steam.

To ensure dimensional stability and to reduce dust and make the fibres water-repellent, they are sprayed with an aqueous solution of binder, dust-binding oil, adhesive agent and - depending on the product - silicones. They are then placed on conveyor belts under negative pressure.

Facings can then be applied optionally. (The corresponding environmental impacts for this are specified in the Appendix.) In a curing oven, which runs continuously, the binder is cured at above 200 °C. The structure and density of the product are adapted to the exact application requirements.

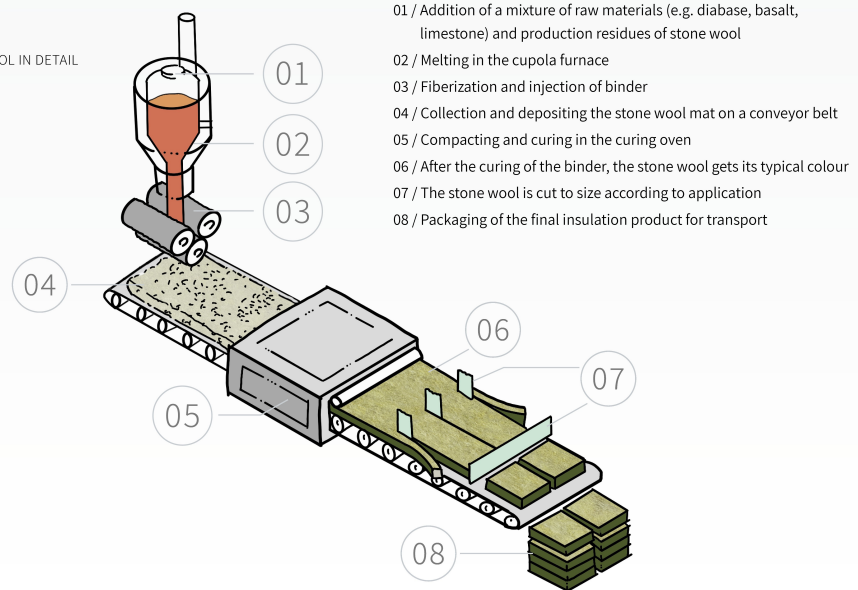
The mineral wool is cut according to the desired size and shape, for example in the form of rolls, mats or boards. The finished products are packed and prepared for shipping. Cut-offs and other mineral wool residues are returned to the production process.

THE PRODUCTION OF GLASS WOOL IN DETAIL



- 01 / Addition of a mixture of raw materials (e.g. recycled glass, silica sand, limestone, soda ash) and production residues of glass wool
- 02 / Melting in glass melting furnace
- 03 / Fiberization and injection of binder
- 04 / Collection and depositing the glass wool mat on a conveyor belt
- 05 / Compacting and curing in the curing oven
- 06 / After the curing of the binder, the glass wool gets its typical colour
- 07 / The glass wool is cut to size according to application
- 08 / Packaging of the final insulation product for transport

THE PRODUCTION OF STONE WOOL IN DETAIL



Quality assurance:

- RAL-GZ 388
- Factory production control and third-party monitoring in accordance with CE marking according to European regulations
- KEYMARK according to *Insulation KEYMARK Scheme Rules 2.1*; for technical insulation according to VDI 2055 according to *KEYMARK Scheme Rules* and AGI-Q 132
- EUCB
- Quality management system according to ISO 9001
- For technical insulation, VDI 2055 / AGI-Q 132 (depending on the product)

2.7 Environment and health during manufacturing

Since 01.06.2000, a ban on the production, placing on the market and use of mineral wool insulation materials which do not fulfil the exemption criteria of Annexe II to § 16 Paragraph 2 of the *Ordinance on Hazardous Substances (GefStoffV)* and Appendix 1 to § 3 of the *Chemicals Prohibition Ordinance (ChemVerbotsV)* has been in force in Germany. At the same time, the exemption criteria of Note Q of the *CLP Regulation (EC) No 1272/2008* must be fulfilled. Regarding the production, the regulations of the Technical Instructions on Air QualityControl (*TA Luft*) apply.

During the entire manufacturing process, no health protection measures exceeding the legally defined health and safety measures for commercial enterprises are required.

The manufacturers have environmental management systems according to *ISO 14001* and attach great importance to the environmental friendliness of the production facilities:

- The exhaust air produced during manufacture is cleaned by various filter systems and partially treated in an afterburner system. Heat exchangers are used to recover the energy for the production process. Separated dust is reused as raw material.
- Production-related waste water is treated internally and returned to the production process
- Noise protection measurements have shown that all values determined inside and outside the production facilities are below the requirements which apply in Germany. Noise-intensive parts of the facility, such as the fiberizing process, are encapsulated accordingly with constructional measures.

2.8 Product processing/Installation

The recommendations on product usage depend on the product and system and are described in the brochures and data sheets.

Mineral wool products can temporarily cause itching of the skin due to the mechanical effects of the fibres. However, mineral wool fibres do not cause chemical or allergic reactions. To avoid unnecessary fibre release, occupational health and safety measures according to section 4 of *DGUV Information 213-031* 'Activities with mineral wool insulation materials (glass wool, stone wool)' must be observed:

- Prefer prefabricated mineral wool insulation materials. These can either be supplied by the manufacturer or cut to size centrally at the construction site.
- Unpack insulation materials only at the workplace.
- Do not throw the material.
- Do not use fast-running motor-driven saws without dust extraction.
- Cut on a solid surface with a knife or scissors, do not tear.
- Ensure good ventilation in the workplace. Avoid raising dust.
- Do not sweep dry or blow off dust and dust deposits with compressed air but pick them up with an industry-standard vacuum cleaner (category M) or wet-clean them.
- Keep the workplace clean and clean regularly. Collect offcuts and waste immediately in suitable containers, e.g. bins or plastic bags.
- Wear loose-fitting, closed work clothing and protective gloves made of leather, nitrile-coated cotton or similar.
- Rinse off building dust with water on finishing work.
- Work with your back to the wind and ensure that no employee stands in the dust trail during outdoor activities which create dust, for example during tipping processes.
- It is recommended to wear protective goggles during grinding work.
- After inhalation of released dust, fresh air is to be provided.
- The general dust limit values must be fulfilled.

The rules and regulations of the employer's liability insurance associations and the respective safety data sheets of the building products apply. No special measures are to be taken to protect the environment. Uncontrolled dust emissions must be avoided.

2.9 Packaging

PE films (waste code 15 01 02 according to 2014/955/EU, cardboard (waste code 15 01 01), as well as disposable and reusable wooden pallets (waste code 15 01 03), are used as packaging materials. Except for reusable wooden pallets, all packaging materials are recycled or disposed of via system providers.

2.10 Condition of use

If used as intended, no changes in the composition are to be expected during the use phase. Possible effects caused by extraordinary impacts are described in 2.13.

2.11 Environment and health during use

According to the current state of knowledge, hazards to water, air and soil are not to be expected if the products described are used as intended.

According to *UBA-Text 30/94* 'Investigations regarding indoor contamination through fibrous fine dust from installed stone wool', the concentration of fibrous dust indoors during the use phase is:

- Generally not increased if the thermal insulation is properly installed; this requires the insulation to be clearly separated from the interior (e.g. insulation on exterior walls or insulation behind an impervious moisture barrier and cladding consisting of gypsum board, wooden panels or similar);
- Generally only moderately increased if the mineral wool products are installed in such a manner that there is a direct air exchange with the interior; this is mainly the case in rooms with suspended (acoustic) ceilings without a functional trickle protection;
- Significantly increased (up to several thousand fibres per m³ room air) in isolated cases, e.g. in the case of structural defects or constructions that do not correspond to the state of the art, or temporarily during construction measures being performed on components that contain mineral wool products.

The emissions of formaldehyde and VOCs determined for the declared products are below the detection and evaluation limits. Carcinogens were not found. The use of the products is therefore to be classified as harmless. Tests have shown that mineral wool products are a negligible source of formaldehyde in buildings and therefore pose no health risk to residents or installers.

2.12 Reference service life

No reference service life (RSL) according to *ISO 15686* was determined. Information on the average service life according to *BBSR 2017* can be found in chapter 4, section "Use phase (B1-B7)". The service life of mineral wool is not limited when used properly and is only determined by the service life of the

building components or the complete building. The insulation performance remains fully intact over the service life. The performance of the insulation can be impaired by extraordinary effects and damage to the construction (see 2.13). According to *EN 16783*, the thermal performance characteristics of thermal insulation materials are normally based on a minimum period of 50 years.

2.13 Extraordinary effects

Fire

The mineral wool insulation materials declared in this EPD are non-combustible and do not show any risk potential regarding smoke production, flaming droplets or toxicity of combustion gases.

Fire safety

Name	Value
Building material class according to EN 13501-1	A1 A2
Classification for smoke production	- s1
Classification for formation of flaming droplets/particles	- d0

Water

Exposure to moisture impairs the insulation properties. Mineral wool insulation materials are vapour permeable and dry out on their own when exposed to low levels of moisture. After longer lasting exposure to water (e.g. in the event of flooding or as a result of a water pipe burst), the insulation material must be replaced. Adverse environmental effects or harmful effects on water quality caused by mineral wool are not known.

Mechanical destruction

Not relevant.

2.14 Re-use phase

Mineral wool insulation materials can be reused. Pure and sorted mineral wool can be returned to the production process. Ground mineral wool can also be used as an additive to produce bricks, fibre cement panels and roof tiles.

2.15 Disposal

Mineral wool insulation materials can be disposed of after use at class II and III landfills. In individual cases, the waste may be assigned to class I landfills with the approval of the competent authorities.

Construction site waste and demolition waste from mineral wool insulation materials are collected under waste code 17 06 04 according to 2014/955/EU.

2.16 Further information

Further information on building with mineral wool insulation materials can be found at: www.fmi-mineralwolle.de

3. LCA: Calculation rules

3.1 Declared Unit

This EPD refers to a declared unit of 1 m³ unfaced mineral wool insulation material with a declared bulk density of 100 kg/m³ (medium bulk density range 60 to 120 kg/m³).

Declared Unit

Name	Value	Unit
Declared unit	1	m ³
Gross density	100	kg/m ³

The declared unit refers to the saleable and packaged end product delivered in mats, boards or rolls. The association average is calculated on the basis of the German plants of the

FMI members.

The declared average includes insulation material made of glass wool, stone wool and Ultimate and therefore a production mix of the melting technologies used. The data collected for the average, refers to the mass produced. Except for packaging, this approach is regarded representative, as for production the same manufacturing steps are necessary in the respective plants. Thus, the conversion of the declared unit into a specific product is possible via a mass-related scaling factor.

Facings that are not linearly scalable with the product weight but based on 1 m² are not included in the average and are

listed in a separate appendix.

3.2 System boundary

The life cycle assessment of mineral wool insulation material includes a *cradle-to-gate* analysis of the products' environmental impacts with options. Subsequent life cycle phases are part of the analysis:

Module A1–A3 | Production stage

The production stage includes the upstream burdens of raw material supply (basalt, dolomite, sand, secondary raw materials, binding agents, etc.), the respective transports and the manufacturing plants of the members of the FMI. The system boundary for secondary raw materials used in production is set after the end of waste status has been reached. The system boundary for secondary raw materials is defined according to *EN 15804*. During production, melting in the melting furnace, fiberization, injection of binder, compacting, curing, cutting and packaging of the mineral wool are considered.

The manufacturing process is modelled based on the primary data of all sites considered.

The production of the facings of mineral wool products is declared in three separate appendices to the EPD.

Module A4 | Transport to construction site

The transport from the plants to the customer is considered as a weighted average based on a representative scenario (360 km truck transport).

Module A5 | Assembly

For installation in the building, a scenario of 2 % waste is declared according to *EURIMA* (2019). The losses during installation are highly dependent on the building geometry and the specific application. Thus, the percentage of waste can vary greatly in the building context and must be adjusted at the building level according to the actual conditions. In addition to the losses during installation, module A5 includes the environmental impacts from the utilization of the packaging of the products.

Module C1 | Deconstruction and demolition

For the disassembly of the mineral wool products, a manual dismantling was assumed. Referring energy demand is considered to be negligible.

Module C2 | Transport to disposal

Module C2 includes the transport to waste treatment. In this case, transport by truck over a transport distance of 50 km is assumed. This corresponds to the recommendations according to *EURIMA* (2019).

Module C3 | Waste processing

The declared scenario assumes landfilling of the mineral wool, therefore no environmental impacts from the waste treatment of the products are declared in C3.

Module C4 | Disposal

Module C4 refers to the emissions from the disposal of the insulation material. The chosen scenario, therefore, includes the environmental burdens of landfilling of the product. The biogenic carbon in the binder of the products is treated as emissions of biogenic CO₂ from the technosphere into the natural environment.

Module D | Benefits and loads beyond the system boundary

In module D the substitution potential from the energy recovery of the packaging is declared.

3.3 Estimates and assumptions

Assumptions and approximations are applied in case of a lack of representative data. All assumptions and approximations are documented precisely and represent a best-guess representation of reality. In case of uncertainty, a conservative approach is chosen.

3.4 Cut-off criteria

The LCA model covers all available input and output flows, which can be represented based on robust data. Data gaps are filled with conservative assumptions from average data (when available) or with generic data and are documented accordingly. Only data with a contribution lower than 1 % were cut off. Thus, no data were neglected, of which a substantial impact is to be expected. All relevant data were collected comprehensively. Cut-off material and energy flows were chosen carefully based on their expected quantitative contribution as well as potential environmental impacts. Thus, it can be assumed that the sum of all neglected input flows does not account for more than 5 % of the total material, water and energy flows. Environmental impacts from the production of machines and infrastructure were not taken into account.

3.5 Background data

This study uses generic background data for the evaluation of upstream environmental impacts from *GaBi*-databases as well as recognised literature sources.

3.6 Data quality

Data collection is based on industry-specific questionnaires. It follows an iterative process clarifying questions via e-mail, telephone calls or in web-meetings. Intensive discussions between the members of the FMI and Daxner & Merl results in an accurate mapping of product-related material and energy flows. This leads to a high quality of foreground data collected. Data collection relies on a consistent process according to *ISO 14044*. The technological, geographical and time-related representativeness of the database was kept in mind when selecting background data. Whenever specific data were missing, either generic datasets or representative average data were used instead. The implemented *GaBi* background datasets refer to the latest versions available (not more than ten years old) and are carefully chosen.

3.7 Period under review

The life cycle inventory of the association members was collected for the production year 2019; respectively 2018 for the exceptions of Ladenburg and St. Egidien. The data are based on the volumes produced on an annual basis.

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

Upstream processes in the supply chain are mainly based on *GaBi* background data sets. In mineral wool production, co-products from other production processes, secondary materials as well as internal and external waste are used. These input materials are taken into account according to the specifications of *EN 15804* - Annex A. Co-products from other production processes (e.g. slag) were allocated according to the recommendations of *EURIMA* (2019).

Secondary material (e.g. waste glass) is assumed burden-free. Environmental impacts from transport to the mineral wool plant were taken into account on a manufacturer-specific basis. External wastes do not reach the end of waste status at the

factory gate. Resulting environmental burdens are allocated to the upstream product system in accordance with a consistent polluter-pays principle.

Co-products (e.g. pig iron) are produced in some of the considered plants. Due to the small quantities and thus minor contribution to overall revenue, no co-product allocation of environmental burdens is applied.

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 *GaBi* background database was used to calculate the LCA (*GaBi* 10; 2020.2).

4. LCA: Scenarios and additional technical information

Characteristic product properties

Information on biogenic carbon

The biogenic carbon content quantifies the amount of biogenic carbon in the declared building product.

Information on the biogenic carbon content at the gate

Name	Value	Unit
Biogenic carbon content (in the product)	0,215	kg/m³
Stored carbon dioxide (in the product)	0,79	kg/m³

Transport to construction site (A4)

Name	Value	Unit
Transport distance	360	km
Means of transport	truck	
Capacity utilisation (including empty runs)	61	%

Assembly (A5)

Name	Value	Unit
Loss of material	2	%
Transport distance to landfilling	50	km
Output substances following waste treatment on site - loss of material	2	kg
Output substances following waste treatment on site - PE-foil	1.39	kg
Output substances following waste treatment on site - wooden pallets	6,90	kg
Output substances following waste treatment on site - paper/cardboard	0,26	kg
Output substances following waste treatment on site - EPS-packaging	0,0065	kg

The use phase of mineral wool insulation materials depends on the respective application and has not been declared. During use, no expenses for inspection, maintenance, servicing, repair or replacement are required. The following table shows the average service lives according to *BBSR 2017*.

Service lives according to BBSR 2017

Name	Value	Unit
Code 335.611: Cavity wall insulation	≥ 50	a
Code 335.641: External thermal insulation composite system (ETICS)	40	a
Code 345.316: Special cladding: Thermal insulation (interior)	≥ 50	a
Code 352.121: Impact sound insulation	≥ 50	a
code 352.122: Floor insulation, including insulation of the top floor	≥ 50	a
Code 353.421: Insulation of the cellar ceiling	≥ 50	a
Code 363.531: Insulation above and between rafters	≥ 50	a
Code 364.211: Insulation above, between and under rafters	≥ 50	a

End-of-Life (C1-C4)

Name	Value	Unit
Collected separately	100	kg
Landfilling	100	kg

5. LCA: Results

The following table contains the LCA results for a declared unit of 1 m³ unfaced mineral wool insulation material with a declared bulk density of 100 kg/m³ (medium bulk density range 60 - 120 kg/m³).

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; ND = 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	MND	X	MND	X	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT according to EN 15804+A2: 1 m³ mineral wool insulation material (100 kg/m³)

Parameter	Unit	A1-A3	A4	A5	C2	C4	D
Global Warming Potential total (GWP-total)	kg CO ₂ eq	1.21E+02	2.18E+00	1.85E+01	3.03E-01	2.19E+00	-6.01E+00
Global Warming Potential fossil fuels (GWP-fossil)	kg CO ₂ eq	1.3E+02	2.17E+00	7.31E+00	3.01E-01	1.52E+00	-6E+00
Global Warming Potential biogenic (GWP-biogenic)	kg CO ₂ eq	-9.23E+00	-3.63E-03	1.12E+01	-5E-04	6.7E-01	-1.41E-02
Global Warming Potential luluc (GWP-luluc)	kg CO ₂ eq	1.1E-01	1.75E-02	2.82E-03	2.43E-03	4.37E-03	-4.22E-03
Depletion potential of the stratospheric ozone layer (ODP)	kg CFC11 eq	5.44E-10	3.97E-16	1.09E-11	5.51E-17	5.62E-15	-6.3E-14
Acidification potential of land and water (AP)	mol H ⁺ eq	1.01E+00	4.44E-03	2.26E-02	6.16E-04	1.09E-02	-8.42E-03
Eutrophication potential aquatic freshwater (EP-freshwater)	kg P eq	7.49E-04	6.59E-06	1.54E-05	9.15E-07	2.6E-06	-7.8E-06
Eutrophication potential aquatic marine (EP-marine)	kg N eq	1.07E-01	1.79E-03	2.84E-03	2.48E-04	2.8E-03	-2.17E-03
Eutrophication potential terrestrial (EP-terrestrial)	mol N eq	3.09E+00	2.03E-02	7.24E-02	2.81E-03	3.08E-02	-2.33E-02
Formation potential of tropospheric ozone photochemical oxidants (POCP)	kg NMVOC eq	3.37E-01	3.85E-03	8.69E-03	5.35E-04	8.48E-03	-6.25E-03
Abiotic depletion potential for non fossil resources (ADPE)	kg Sb eq	2.82E-05	1.75E-07	5.98E-07	2.43E-08	1.36E-07	-9.9E-07
Abiotic depletion potential for fossil resources (ADPF)	MJ	1.6E+03	2.89E+01	3.6E+01	4.01E+00	1.99E+01	-1.02E+02
Water use (WDP)	m ³ world eq deprived	1.68E+00	2.11E-02	1.6E+00	2.93E-03	1.59E-01	-6.24E-01

RESULTS OF THE LCA - INDICATORS TO DESCRIBE RESOURCE USE according to EN 15804+A2: 1 m³ mineral wool insulation material (100 kg/m³)

Parameter	Unit	A1-A3	A4	A5	C2	C4	D
Renewable primary energy as energy carrier (PERE)	MJ	2.17E+02	1.67E+00	1.22E+02	2.32E-01	2.61E+00	-2.23E+01
Renewable primary energy resources as material utilization (PERM)	MJ	1.4E+02	0	-1.14E+02	0	0	0
Total use of renewable primary energy resources (PERT)	MJ	3.57E+02	1.67E+00	7.78E+00	2.32E-01	2.61E+00	-2.23E+01
Non renewable primary energy as energy carrier (PENRE)	MJ	1.39E+03	2.9E+01	9.34E+01	4.02E+00	1.99E+01	-1.02E+02
Non renewable primary energy as material utilization (PENRM)	MJ	2.14E+02	0	-5.74E+01	0	0	0
Total use of non renewable primary energy resources (PENRT)	MJ	1.6E+03	2.9E+01	3.61E+01	4.02E+00	1.99E+01	-1.02E+02
Use of secondary material (SM)	kg	1.08E+01	0	2.16E-01	0	0	0
Use of renewable secondary fuels (RSF)	MJ	0	0	0	0	0	0
Use of non renewable secondary fuels (NRSF)	MJ	0	0	5.77E-01	0	0	0
Use of net fresh water (FW)	m ³	3.39E-01	1.95E-03	4.35E-02	2.7E-04	5.02E-03	-2.59E-02

RESULTS OF THE LCA - WASTE CATEGORIES AND OUTPUT FLOWS according to EN 15804+A2: 1 m³ mineral wool insulation material (100 kg/m³)

Parameter	Unit	A1-A3	A4	A5	C2	C4	D
Hazardous waste disposed (HWD)	kg	3.92E-06	1.34E-06	1.17E-07	1.86E-07	3.03E-07	-4.1E-08
Non hazardous waste disposed (NHWD)	kg	9.25E+00	4.59E-03	2.28E+00	6.38E-04	1E+02	-4.71E-02
Radioactive waste disposed (RWD)	kg	3.26E-02	5.34E-05	8.26E-04	7.42E-06	2.26E-04	-7.62E-03
Components for re-use (CRU)	kg	0	0	0	0	0	0
Materials for recycling (MFR)	kg	0	0	2.61E-01	0	0	0
Materials for energy recovery (MER)	kg	0	0	0	0	0	0
Exported electrical energy (EEE)	MJ	0	0	2.55E+01	0	0	0
Exported thermal energy (EET)	MJ	0	0	4.56E+01	0	0	0

RESULTS OF THE LCA – additional impact categories according to EN 15804+A2-optional: 1 m³ mineral wool insulation material (100 kg/m³)

Parameter	Unit	A1-A3	A4	A5	C2	C4	D
Incidence of disease due to PM emissions (PM)	Disease incidence	ND	ND	ND	ND	ND	ND
Human exposure efficiency relative to U235 (IR)	kBq U235 eq	ND	ND	ND	ND	ND	ND
Comparative toxic unit for ecosystems (ETP-fw)	CTUe	ND	ND	ND	ND	ND	ND
Comparative toxic unit for humans (carcinogenic) (HTP-c)	CTUh	ND	ND	ND	ND	ND	ND
Comparative toxic unit for humans (noncarcinogenic) (HTP-nc)	CTUh	ND	ND	ND	ND	ND	ND
Soil quality index (SQP)	SQP	ND	ND	ND	ND	ND	ND

The additional and optional impact categories according to *EN 15804+A2* are not declared, as the uncertainty of these indicators is to be classified as high.

Disclaimer 1 – for the indicator 'Potential Human exposure efficiency relative to U235'.

This impact category deals mainly with the eventual impact of low dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator.

Disclaimer 2 – for the indicators 'abiotic depletion potential for non-fossil resources', 'abiotic depletion potential for fossil resources', 'water (user) deprivation potential, deprivation-weighted water consumption', 'potential comparative toxic unit for ecosystems', 'potential comparative toxic unit for humans – carcinogenic', 'Potential comparative toxic unit for humans - not cancerogenic', 'potential soil quality index'.

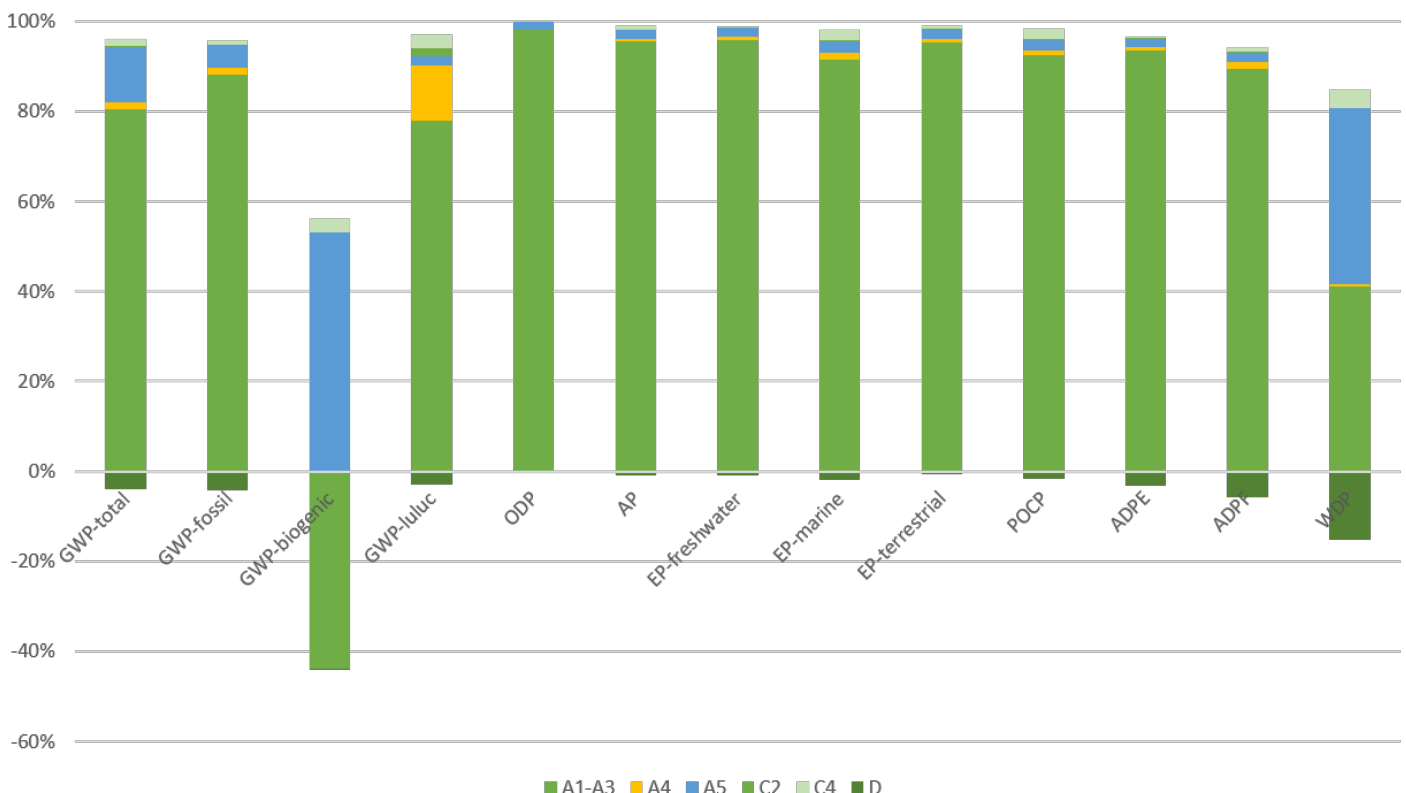
The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.

6. LCA: Interpretation

The following interpretation contains a summary of the LCA results referenced to a declared unit of 1 m³ unfaced mineral

wool insulation material.

Life cycle impact assessment of mineral wool (medium bulk density range)



The comparison of the product's life cycle phases shows a clear dominance of the production phase of mineral wool (modules A1–A3) in all environmental impact categories. Regarding the contribution of biogenic emissions to climate change (GWP-biogenic), the carbon storage effect of packaging made from renewable raw materials is visible as a negative value in modules A1–A3. During energy recovery of the

packaging in module A5, the stored carbon is released again in terms of a closed carbon balance.

The direct emissions from the production processes of the products at the members' sites can be identified as the main influencing factor of the potential contribution to climate change (fossil), acidification, eutrophication and photochemical ozone

creation. The potential contribution to climate change is additionally influenced by the upstream chains of the energy used in production (electricity, natural gas, coke, etc.).

The supply chains of the raw materials and energy sources used represent the dominant factors in the other environmental

indicators considered. In particular, the potential abiotic fossil resource use, contribution to water scarcity as well as greenhouse gas emissions from land use change, are dominated by the provision of the electrical energy used and the upstream chain of the respective energy sources.

7. Requisite evidence

7.1 Biopersistence

The biopersistence of the declared mineral wool fibres is proven by the RAL quality mark "Products made of mineral wool" under the registration number RAL-GZ 388. The requirements of RAL-GZ correspond to the exemption criteria of the ChemVerbotsV (Appendix 1 to § 3 entry 4 column 3) and the GefStoffV (Appendix II to § 16 paragraph 2 number 5). Compliance with the requirements of the CLP Regulation (Note Q) is verified by the EUCB quality mark.

7.2 Radioactivity

There are currently no legally defined limit values for the assessment of the radioactivity of building materials in Germany. The nuclides found during measurements are naturally occurring radioactive substances. No artificial radioactive substances were found.

7.3 Leaching

Not relevant, as the products are not used in areas permanently exposed to water.

7.4 Formaldehyde- and VOC-emissions

The results are based on the laboratory tests commissioned by the manufacturers.

AgBB results overview (28 days [$\mu\text{g}/\text{m}^3$])

Name	Value	Unit
TVOC (C6 - C16)	≤ 1	mg/m^3
Total SVOC (C16 - C22)	$\leq 0,1$	mg/m^3
R (dimensionless)	< 1	
VOC without NIK	$\leq 0,1$	mg/m^3
Carcinogens	$\leq 0,001$	mg/m^3
Formaldehyde	≤ 60	$\mu\text{g}/\text{m}^3$

AgBB results overview (3 days [$\mu\text{g}/\text{m}^3$])

Name	Value	Unit
TVOC (C6 - C16)	≤ 10	mg/m^3
Carcinogens	$\leq 0,01$	mg/m^3

Further information on formaldehyde emissions according to EN 16516 in 2.4.

8. References

Standards

DIN 4108-4

DIN 4108-4:2020-11, Thermal insulation and energy economy in buildings – Part 4: Hygrothermal design values.

DIN 4108-10

DIN 4108-10:2015-12, Thermal insulation and energy economy in buildings – Part 10: Application-related requirements for thermal insulation materials - Factory made products.

EN 13501-1

DIN EN 13501-1:2019-05, Fire classification of construction products and building elements - Part 1: Classification using data from reaction to fire test.

EN 13162

DIN EN 13162:2015-04, Thermal insulation products for buildings - Factory made mineral wool (MW) products - Specification.

EN 14064-1

DIN EN 14064-1:2019-04, Thermal insulation products for buildings - In-situ formed loose-fill mineral wool (MW) products – Part 1: Specification for the loose-fill products before installation.

EN 14303

DIN EN 14303:2016-08, Thermal insulation products for building equipment and industrial installations - Factory made mineral wool (MW) products - Specification.

EN 15804

DIN EN 15804:2020-03. Sustainability of construction works - Environmental Product Declarations - Core rules for the product category of construction products. German version EN

15804:2012+A2:2019.

EN 16516

DIN EN 16516:2020-10, Construction products: Assessment of release of dangerous substances - Determination of emissions into indoor air.

EN 16733

DIN EN 16733:2016-07, Reaction to fire tests for building products - Determination of a building product's propensity to undergo continuous smouldering.

EN 16783

DIN EN 16783:2017-07, Thermal insulation products - Product category rules (PCR) for factory made and in-situ formed products for preparing environmental product declarations.

ISO 9001

DIN EN ISO 9001:2015-11, Quality management systems - Requirements.

ISO 14001

DIN EN ISO 14001:2015-11, Environmental management systems - Requirements with guidance for use.

ISO 14025

DIN EN ISO 14025:2011-10, Environmental labels and declarations - Type III environmental declarations - Principles and procedures.

ISO 14044

DIN EN ISO 14044:2006-10, Environmental management – Life cycle assessment – Requirements and guidelines.

ISO 15686

ISO 15686, Buildings and constructed assets - Service life

planning, various parts.

Further references

AgBB

Ausschuss zur gesundheitlichen Bewertung von Bauprodukten (AgBB) (Committee for health-related evaluation of building products): Vorgehensweise bei der gesundheitlichen Bewertung der Emissionen von flüchtigen organischen Verbindungen (VOC und SVOC) aus Bauprodukten.

AGI-Q 132

AGI worksheet Q132 on stone wool as insulation material for industrial installations, Arbeitsgemeinschaft Industriebau e.V., Bensheim, December 2016.

AVV

Waste Catalogue Ordinance (German designation: Abfallverzeichnisverordnung – AVV) of 10 December 2001 (Federal Law Gazette I p. 3379), last amended by Article 1 of the Ordinance of 30 June 2020 (Federal Law Gazette I p. 3005).

BBSR 2017

Service life of building components for lifecycle analysis in accordance with BNB, version dated 24 February 2017.

Biocidal Products Regulation

Regulation (EU) No 528/2012 of the European Parliament and of the Council of 22 May 2012 concerning the making available on the market and use of biocidal products.

ChemVerbotsV

Chemicals Prohibition Ordinance (German designation: Chemikalien-Verbotsverordnung – ChemVerbotsV) of 20 January 2017 (Federal Law Gazette I p. 94; 2018 I p. 1389), last amended by Article 300 of the Ordinance of 19 June 2020 (Federal Law Gazette I p. 1328).

CLP Regulation

Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures, last amended by Commission Delegate Regulation (EU) No 2020/217 of 4 October 2019 (OJ L 44, 18.02.2020, p. 1-14).

DGUV Information 213-031

Deutsche Gesetzliche Unfallversicherung e. V.: DGUV Information 213-031 "Activities with mineral wool insulation materials (glass wool, stone wool)", July 2019.

EAD 040729-00-1201

European Assessment Document (EAD) 040729-00-1201, Thermal insulation made of loose fill mineral wool, September 2017.

ECHA Candidate List

Candidate List of Substances of Very High Concern (ECHA Candidate List) of 16 January 2020, published in accordance with Article 59(10) of the REACH Regulation Helsinki: European Chemicals Agency.

EUCEB

European Certification Board for mineral wool products.

EURIMA

EURIMA, 2019. Common Scenarios for developing LCA for mineral wool. A EURIMA internal Document. Version 1. 09.09.2019.

GaBi

GaBi 10, Software-System and Database for Life Cycle Engineering. DB v8.7 2020.2. Sphera, 1992-2020. Available at: <http://documentation.gabi-software.com>.

GefStoffV

Ordinance on Hazardous Substances (German designation: Gefahrstoffverordnung – GefStoffV) of 26 November 2010 (Federal Law Gazette I p. 1643, 1644), last amended by Article 148 of the Law of 29 March 2017 (Federal Law Gazette I p. 626).

IBU 2016

Institut Bauen und Umwelt e.V.: General Programme Instructions for the Preparation of EPDs at the Institut Bauen und Umwelt e.V., Version 1.1 Institut Bauen und Umwelt e.V., Berlin www.ibu-epd.com

Insulation KEYMARK Scheme Rules 2.1

European INSULATION KEYMARK Scheme for Thermal Insulation Products; Revision: 2.1, CEN, September 2019.

PCR Part A

Institut Bauen und Umwelt e.V. (IBU), 2019. Product Category Rules for Building-Related Products and Services. Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Project Report according to EN 15804+A2:2019. Version 1.1. Berlin, 08.01.2021.

PCR: Mineral insulating materials

Institut Bauen und Umwelt e.V., 2019. Product Category Rules for Building-Related Products and Services. Part B: Requirements on the EPD for Mineral insulating materials. Version 1.7 Berlin, 08.01.2019.

RAL

RAL Deutsches Institut für Gütesicherung und Kennzeichnung.

RAL-GZ 388

RAL-GZ 388:2017-08 Erzeugnisse aus Mineralwolle - Gütesicherung. Mineral Wool Quality Seal.

TA Luft

First General Administrative Regulation on the Federal Immission Protection Act (Technical Instructions on Air Quality Control – TA Luft) of 24 July 2002 (Joint Ministerial Gazette 2002 p. 511-605).

UBA-Text 30/94

Federal Environment Agency (Ed.): Investigations on indoor contamination by fibrous fine dust from installed mineral wool products; UBA text 30/94, Federal Environmental Agency (Umweltbundesamt – UBA), 1994, Berlin.

VDI 2055

Thermal insulation of heated and refrigerated operational installations.

Regulation (EU) No 305/2011 (CPR)

Regulation (EU) No 305/2011 of the European Parliament and of the Council of 9 March 2011 laying down harmonised conditions for the marketing of construction products and repealing Council Directive 89/106/EEC.

2014/955/EU

Commission Decision 2014/955/EU of 18 December 2014 amending Decision 2000/532/EC on the list of waste pursuant to Directive 2008/98/EC.



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