ENVIRONMENTAL PRODUCT DECLARATION

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

Owner of the Declaration	Knauf Ceiling Solutions GmbH & Co. KG
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-KNA-20210115-IBD2-EN
Issue date	25.05.2021
Valid to	24.05.2026

AMF THERMATEX & ARMSTRONG Acoustic Range (Pontarlier)

Knauf Ceiling Solutions GmbH & Co. KG

Institut Bauen und Umwelt e.V.

ECO PLATFORM EPD VERIFIED

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1. General Information

Knauf Ceiling Solutions GmbH & Co. KG

Programme holder

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

Declaration number

EPD-KNA-20210115-IBD2-EN

This declaration is based on the product category rules:

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

Issue date

25.05.2021

Valid to

24.05.2026

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

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

AMF THERMATEX & ARMSTRONG Acoustic Range (Pontarlier)

Owner of the declaration

Knauf Ceiling Solutions GmbH & Co. KG
Elsenthal 15
94481 Grafenau
Germany

Declared product / declared unit

1 m² THERMATEX/ARMSTRONG Acoustic Range mineral ceiling tiles with an average surface weight of 2,84 kg/m².

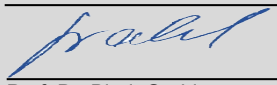
Scope:

This document refers to 1 m² THERMATEX/ARMSTRONG Acoustic Range mineral ceiling tiles with an average recipe and an average surface weight of 2,84 kg/m², manufactured at the production facility in Pontarlier, France under the brand names THERMATEX and ARMSTRONG.
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



Prof. Dr. Birgit Grahl,
(Independent verifier)

2. Product

2.1 Product description/Product definition

The ceiling tiles are manufactured using a wet felt process and consist of biosoluble mineral wool, perlite, clay and starch. The ceiling tiles meet the requirements of *DIN 18177* and *EN 13964*.

The AMF and Armstrong mineral tiles are available in a wide range of different surface designs and product properties. Depending on the design, the ceiling tiles are available in different formats and edge finishes.

This EPD applies to the following products:
Armstrong Perla OP 0.95, Armstrong Perla OP 1.00, Armstrong Ultima+ Alpha, THERMATEX Acoustic, Ultima+ Acoustic, Armstrong Perla, Armstrong Bioguard Acoustic, Armstrong Bioguard Acoustic OP, Armstrong Saniguard, Armstrong Sierra, Armstrong Sierra OP, Armstrong Solara, THERMATEX Antaris, THERMATEX Antaris C. Armstrong Ultima, THERMATEX Thermofon, Adagio Acoustic+, Adagio Alpha+.The declared average represents a potential underestimation of the environmental impact associated to the products Perla OP1.
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 product needs a declaration of performance taking into consideration *EN 13964:2014*, suspended ceiling requirements and test methods and the CE-marking. For the application and use the respective national provisions apply.

2.2 Application

Mineral tiles (wet-felt) are typically used as lay in for suspended ceiling constructions. They are primarily used as optical cladding, but also for sound absorption and sound insulation, for fire resistance and against fire spreading, for cleanrooms and high hygiene requirements.

2.3 Technical Data

Mineral boards (wet-felt) are regulated by *EN 13964* and have corresponding labelling and declaration of performance. The following data provide an overview of results:

Construction data (according to DIN 18177)

Name	Value	Unit
Thermal conductivity	0.04 - 0.06	W/(mK)
Sound absorption coefficient acc. ISO 354 and ISO 11654	0.65 - 1	%
Airborne sound reduction acc. ISO 10848-2 and EN 717-1	25 - 38	dB
Gross density	150 - 270	kg/m^3

Performance data of the product in accordance with the declaration of performance with respect to its essential characteristics according to *EN 13964:2014*, suspended ceiling requirements and test methods (not part of CE-marking).

2.4 Delivery status

The EPD refers to panels with a thickness between 15 - 20 mm which can have variable length and width dimensions.

2.5 Base materials/Ancillary materials

Mineral tile composition:

Name	Value	Unit
Mineral wool	20 - 90	%
Perlite	8 - 35	%
Clay	0 - 25	%
Cellulose fibres	2 - 5	%
Starch	5 - 15	%
others	0 - 5	%

In addition, glass fiber fleece and dispersion paints are used on the surface and water for preparation during production. The recycled content is at least 42 %.

This product/article/at least one partial article contains substances listed in the *ECHA-candidate list* (date: 25.06.2020) exceeding 0.1 percentage by mass: No

This product/article/at least one partial article contains other carcinogenic mutagenic reprotoxic (CMR) substances in categories 1A or 1B which are not on the 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 (EU) *Ordinance on Biocide Products* No. 528/2012): No

In-can preservatives are used in the production process; however, they are not part of the products and are therefore not within the scope of the *Ordinance on Biocide Products*.

Colemanite (2CaO – 3B2O3 – 5H2O) is used as a flame retardant in some tiles up to 2 % in the final product.

2.6 Manufacture

The mineral tiles are produced in the traditional wet process (wet-felt). The raw materials are mixed with water to form a homogeneous suspension, which is pumped onto a belt conveyor (Fourdrinier). The water is removed mechanically (gravity and vacuum) and by evaporation in the drying oven. As far as possible, the process water is reused. It is treated accordingly and fed back into the process water circuit. Depending on the desired appearance the panels can be sanded, colour-treated, patterned, eroded or embossed. Production waste and dust are reused in the process in the sense of an internal cycle.
The manufacturing plant is certified according to *ISO 9001*, *ISO 14001* and *OHSAS 18001*.

2.7 Environment and health during manufacturing

The manufacturer complies with all European regulations for the production of mineral slabs:

- The manufacturing plant is certified according to *ISO 9001, ISO 14001* and *OHSAS 18001*
- The production has a closed water cycle, i.e. no waste water is produced
- Production generates virtually almost no waste, all resulting blanks, dust and rejects are reused to 99%
- Exclusive use of mineral fibres according to *Regulation (EU) No.1272/2008* Note Q
- Prohibition of the production and use of biopersistent fibres (*Ordinance on Hazardous Substances*, Annex II, No. 5)
- Prohibition of placing biopersistent fibres on the market (*Chemicals Prohibition Order*, No.23 of the Annex to §1)
- Not subject to declaration according to *REACH*

2.8 Product processing/Installation

There are no recognised systemic hazards associated with the installation of ceiling tiles. It is recommended that materials are handled in a manner that minimises dust generation. Workers should wear appropriate personal protective equipment. Equipment such as gloves, goggles and dust masks are recommended to minimise exposure to dust and prevent skin irritation.

2.9 Packaging

The panels are packaged with cardboard boxes and sealed with transparent polyethylene film.These packages lie on chemically untreated wooden pallets. The pallets are wrapped with polyethylene stretch film. Foil, paper and wood can be recycled in the usual ways.

2.10 Condition of use

When handled properly, the mechanical and structural-physical properties of the mineral tile remain intact throughout its entire service life. Direct contact with water should be avoided due to the water-soluble binding agent starch.

2.11 Environment and health during use

When properly installed, no dust/particles are released during the use phase. For the substance groups formaldehyde, volatile organic compounds (VOCs) and total volatile organic compounds (TVOCs), the limits according to *DIN 18177* are complied with.

2.12 Reference service life

The service life of the mineral tiles (wet-felted) is up to 50 years, depending on the area of use, exposure and state of maintenance. Within the framework of the conditions of use, no ageing effects are to be expected apart from visual discolouration caused by air circulation.

2.13 Extraordinary effects

Fire

The declared products are classified in the fire reaction class A2-s1, d0 according to *EN 13501-1*. This means that they are "non-combustible" according to the German building authority designation (and also many other European countries) with negligible smoke development and no burning drip in the event of fire.

Fire Reaction

Name	Value
Building material class	A2
Smoke gas development	s1
Burning droplets	d0

Water

In the case of prolonged contact with water, the starch binder dissolves, which can lead to a loss of structure, and if the soluble components are discharged into the sewage treatment plant, they are biodegradable, increasing the chemical oxygen demand (COD) and the biological oxygen demand (BOD).

Mechanical destruction

The mineral tiles (wet-felt) can be broken by hand and also damaged superficially, which can result in dust formation.

2.14 Re-use phase

If the panels are removed properly, they can be reinstalled. In case of minor damage, the slabs can be reused as cut-to-size tiles. Mineral tiles can be returned to the manufacturing process if they are of the correct type and have sufficient material quality; they can be recycled up to 100 %.

2.15 Disposal

The waste code number of production residues for mineral tiles according to the *AVV*, *German List of Wastes Ordinance* is 10 11 03, the waste code number for construction site waste (offcuts) is 17 06 04. If the tiles are not recycled as described in 2.14., they are disposed of in a landfill.

2.16 Further information

Further information at www.knaufceilingsolutions.com
DoPs at knaufamf-dop.com or
www.knaufarmstrong.com/dop.html

3. LCA: Calculation rules

3.1 Declared Unit

This EPD refers to a declared unit of 1 m²
THERMATEX/Armstrong Acoustic Range ceiling tiles with an average surface weight of 2,84 kg/m².

Declared unit

Name	Value	Unit
Declared unit	1	m^2
Grammage	2.84	kg/m^2
Layer thickness	0,017	m
conversion factor [Mass/Declared Unit]	2.84	-

The ceiling tiles are produced at the Knauf Ceiling Solutions production site in Pontarlier, France under the brand names THERMATEX and Armstrong.

Various types of mineral ceiling tiles are produced at the site. A differentiation between the product groups was made based on the recipe of the products. Acoustic products have common product components and are manufactured in different thicknesses. Acoustic panels are provided with a glass fleece coating. The calculation of the weighted average recipe and surface weight is based on the square meters produced of each product. Ensuring the correct representation of the average composition of the raw boards, the recipe of each of the products included in the average was considered.

3.2 System boundary

The life cycle assessment of average THERMATEX/Armstrong Acoustic Range mineral ceiling tiles 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, their transports and the manufacturing plant of Knauf Ceiling Solutions located in Pontarlier (France). Mineral ceiling tiles are produced in the wet-felt process.
Main raw material inputs, therefore, refer to mineral wool, perlite, clay and starch. The production site is supplied with electricity from the French power grid and thermal energy from natural gas.

Module A4 | Transport from the gate to the site

Module A4 includes transport to the construction site. For this purpose, transport by truck over a distance of 470 km is used as a representative scenario.

Module A5 | Assembly at the site

For installation in the building, a scenario of 5 % loss is declared in this EPD. The losses during installation in the

building are strongly 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 accordingly at the building level according to the actual conditions. In addition to the losses during installation in the building, Module A5 includes the environmental impacts from the End-of-Life of the packaging of the products.

Module C1 | Deconstruction and demolition
Disassembly of the product is done either manually or using smaller tools. Referring energy demand is considered to be negligible.

Modul C2 | Transport to disposal
The transport to the disposal of the material is estimated declaring a 50 km radius to the landfill. In reality, this scenario may vary depending on the actual location of deconstruction and referring waste treatment.

Module C3 | Waste processing
The declared scenario assumes landfilling of the product. Referring environmental impacts are accounted for in module C4.

Module C4 | Disposal
Module C4 refers to the emissions from the disposal of the mineral ceiling tiles. The chosen scenario, therefore, includes the environmental burdens of landfilling of the product.

Module D | Benefits and loads beyond the system boundary
The declared scenario assumes landfilling of the product. Referring environmental impacts are accounted for in module C4. Module D declares the substitution potential from energy recovery of the incineration of packaging waste in module A5.

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 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.

3.5 Background data
This study uses generic background data for the evaluation of upstream environmental impacts from *GaBi* databases (*GaBi* 10; 2020.2).

3.6 Data quality
Data collection is based on product-specific questionnaires. It follows an iterative process clarifying questions via e-mail, telephone calls or in personal/web meetings. Intensive discussions between Knauf Ceiling Solutions 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 weighted average was calculated based on the product-specific recipes and composition. Its representativity is considered to be good for 88 % of the THERMATEX/Armstrong Acoustic products.

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
Foreground data were collected in the 2019 production year, and 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: France

3.9 Allocation
All information for the allocation of given material and energy flows is based on the site-related evaluations. The calculation of specific input quantities for the raw board production of the analysed product group is based on the respective recipe. In addition, product-specific application rates (e.g. basecoat, top coat, glass fleece etc.) were available for the upscaling of referring input quantities. Total annual energy consumption and waste flows are allocated based on the production share of each product.

For in the production used waste paper, the system boundary is set after sorting. It is assumed that the end of waste status has been reached. Waste glass wool does not reach the end of waste status. The system boundary for secondary raw materials defined in *EN 15804* applies.

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. Zur Berechnung der Ökobilanz wurde die -Hintergrunddatenbank verwendet

4. LCA: Scenarios and additional technical information

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

Information on the description of the biogenic carbon content at the factory gate

Name	Value	Unit
Biogenic carbon content in product	0.12	kg C
Biogenic carbon content in accompanying packaging	0.06	kg C

Transport to the site (A4)

Name	Value	Unit
Litres of fuel (fully loaded)	53	l/100km
Litres of fuel (empty)	14	l/100km
Transport distance	470	km
Capacity utilisation (including empty runs)	61	%
Gross density of products transported	173	kg/m^3

Assembly (A5)

Name	Value	Unit
Packaging (cardboard)	0,02	kg/m^2
Packaging (pallets)	0,12	kg/m^2
Packaging (PE-foil)	0,01	kg/m^2

Reference service life

Name	Value	Unit
Declared product properties (at the gate) and finishes	Placing on the market according to EN 13964; see also document centre on the website knaufceilingsolutions.com	-
Design application parameters (if instructed by the manufacturer), including the references to the appropriate practices and application codes	See document centre on the website knaufceilingsolutions.com	-
Indoor environment (for indoor applications), e.g. temperature, moisture, chemical exposure	The exposure classes of ceiling tiles vary depending on the product, from a fluctuating relative humidity up to 95 % at 30 °C, without corrosive impurities.	-
Usage conditions, e.g. frequency of use, mechanical exposure	No mechanical stress during conventional use.	-
Maintenance e.g. required frequency, type and quality and replacement of components	As a rule, the ceiling tiles do not need to be cleaned for the duration of their use in normal application. However, the ceiling tiles can be cleaned dry and damp according to the cleaning guideline.	-

End-of-Life (C1-C4)

Name	Value	Unit
Collected separately	2.84	kg
Landfilling	2.84	kg

5. LCA: Results

The following table contains the LCA results for a declared unit of 1 m² average THERMATEX/Armstrong Acoustic Range mineral ceiling tiles with an average surface weight of 2,84 kg/m².

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	X	X	X	X	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT according to EN 15804+A2: 1 m² THERMATEX/Armstrong Acoustic Range mineral ceiling tiles (2,84 kg/m²)

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
GWP-total	kg CO_2 eq	3.87E+00	7.96E-02	2.46E-01	0	8.47E-03	0	4.74E-01	-8.95E-03
GWP-fossil	kg CO_2 eq	4.32E+00	8.06E-02	2.47E-01	0	8.58E-03	0	4.31E-02	-8.94E-03
GWP-biogenic	kg CO_2 eq	-4.49E-01	-1.98E-03	-8.78E-04	0	-2.1E-04	0	4.31E-01	-1.11E-06
GWP-luluc	kg CO_2 eq	1.9E-03	9.6E-04	1.02E-04	0	1.02E-04	0	1.24E-04	-2.61E-06
ODP	kg CFC11 eq	1.54E-11	1.3E-17	7.69E-13	0	1.38E-18	0	1.6E-16	-6.96E-17
AP	mol H^+ eq	1.79E-02	2.88E-04	9.15E-04	0	3.06E-05	0	3.09E-04	-8.35E-06
EP-freshwater	kg P eq	7.8E-05	5.55E-07	3.9E-06	0	5.91E-08	0	7.4E-08	-5.66E-09
EP-marine	kg N eq	3.39E-03	1.25E-04	1.74E-04	0	1.34E-05	0	7.95E-05	-3.01E-06
EP-terrestrial	mol N eq	5.47E-02	1.43E-03	2.79E-03	0	1.53E-04	0	8.74E-04	-3.2E-05
POCP	kg NMVOC eq	7.61E-03	2.44E-04	3.95E-04	0	2.59E-05	0	2.41E-04	-8.59E-06
ADPE	kg Sb eq	5.21E-07	7.54E-09	2.63E-08	0	8.02E-10	0	3.87E-09	-1.23E-09
ADPF	MJ	7.94E+01	1.04E+00	4E+00	0	1.11E-01	0	5.65E-01	-2.58E-01
WDP	m^3 world eq deprived	2.02E-01	1.19E-03	1.3E-02	0	1.26E-04	0	4.51E-03	-5.52E-04

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 THERMATEX/Armstrong Acoustic Range mineral ceiling tiles (2,84 kg/m²)

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
PERE	MJ	4.23E+00	8.47E-02	2.16E-01	0	9.01E-03	0	7.4E-02	-2.67E-02
PERM	MJ	5.58E+00	0	2.79E-01	0	0	0	0	0
PERT	MJ	9.81E+00	8.47E-02	4.95E-01	0	9.01E-03	0	7.4E-02	-2.67E-02
PENRE	MJ	7.87E+01	1.05E+00	3.97E+00	0	1.11E-01	0	5.65E-01	-2.58E-01
PENRM	MJ	6.7E-01	0	3.35E-02	0	0	0	0	0
PENRT	MJ	7.94E+01	1.05E+00	4E+00	0	1.11E-01	0	5.65E-01	-2.58E-01
SM	kg	8.99E-01	0	4.49E-02	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	6.44E-03	1.36E-04	3.92E-04	0	1.44E-05	0	1.43E-04	-6.29E-05

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 THERMATEX/Armstrong Acoustic Range mineral ceiling tiles (2,84 kg/m²)

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
HWD	kg	4.17E-07	1.31E-07	2.13E-08	0	1.4E-08	0	8.62E-09	-5.92E-11
NHWD	kg	6.54E-01	2.23E-04	1.75E-01	0	2.38E-05	0	2.84E+00	-7.23E-05
RWD	kg	4.58E-03	5.06E-06	2.3E-04	0	5.38E-07	0	6.42E-06	-4.67E-05
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	6.18E-02	0	0	0	0	0
EET	MJ	0	0	1.1E-01	0	0	0	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 THERMATEX/Armstrong Acoustic Range mineral ceiling tiles (2,84 kg/m²)

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
PM	Disease incidence	1.58E-07	1.68E-09	8.1E-09	0	1.79E-10	0	3.83E-09	-7.07E-11
IR	kBq U235 eq	1.09E+00	1.17E-03	5.44E-02	0	1.24E-04	0	6.6E-04	-1.19E-02
ETP-fw	CTUe	2.39E+01	8.63E-01	1.21E+00	0	9.18E-02	0	3.23E-01	-6.86E-02
HTP-c	CTUh	2.82E-09	1.93E-11	1.44E-10	0	2.06E-12	0	4.79E-11	-1.47E-12
HTP-nc	CTUh	5.85E-08	1.25E-09	3.2E-09	0	1.33E-10	0	5.27E-09	-5.42E-11
SQP	SQP	6.96E+01	7.39E-01	3.48E+00	0	7.86E-02	0	1.18E-01	-1.28E-02

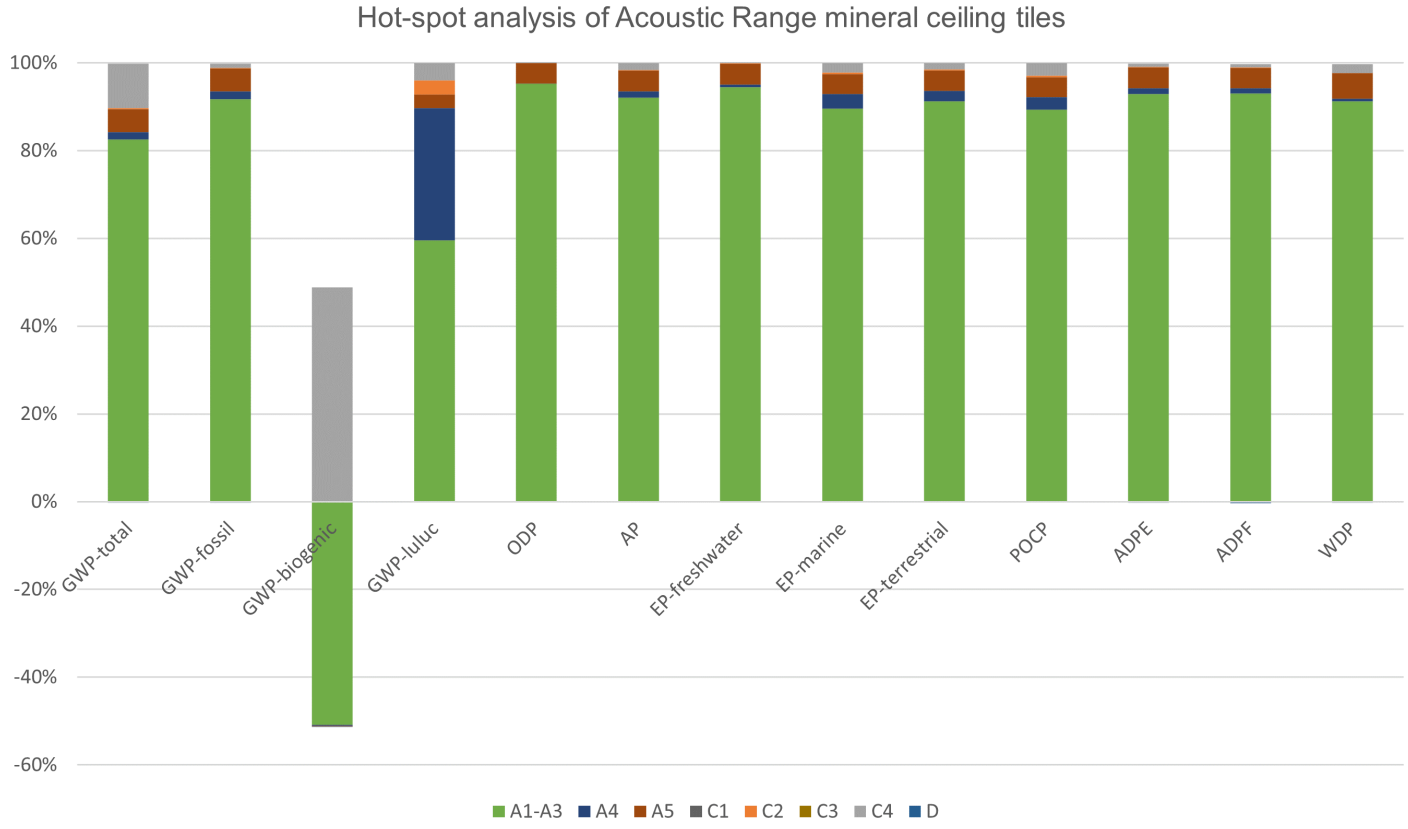
PM = Potential incidence of disease due to PM emissions; IR = Potential Human exposure efficiency relative to U235; ETP-fw = Potential comparative Toxic Unit for ecosystems; HTP-c = Potential comparative Toxic Unit for humans (cancerogenic); HTP-nc = Potential comparative Toxic Unit for humans (not cancerogenic);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

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 or radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, 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 – cancerogenic”, “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 as there is limited experience with the indicator.

6. LCA: Interpretation

The following interpretation contains a summary of the LCA results referenced to a functional unit of 1 m² average THERMATEX/Armstrong Acoustic Range mineral ceiling tiles.



The comparison of the product's life cycle phases shows a clear dominance of the production phase (modules A1-A3) in all environmental impact categories. The potential environmental impacts from transport to disposal (module C2) and the End-of-Life of the products due to landfilling (module C4) have a minor contribution.

The direct emissions from the combustion of natural gas for the production process represent the main driver when it comes to potential climate change (GWP) as well as depletion of fossil

resources (ADPF). Potential acidification (AP), photooxidant creation (POCP) as well as terrestrial eutrophication (EP-terrestrial) are dominated by direct emissions from natural gas combustion, the upstream supply chain of stone wool as well as starch. Potential eutrophication of marine ecosystems (EP-marine) is mainly affected by upstream emission from starch production and direct emissions at the site as well. When it comes to eutrophication potential of freshwater (EP-freshwater) the share of the upstream supply chain of starch represents the most dominant factor. Electricity from the French grid represents an important driver when it comes to potential water scarcity (WDP).

The declared environmental impacts represent a weighted average of the THERMATEX/Armstrong Acoustic product group. The analysis of the variance of the specific composition of the products within the group shows a good representativity of the results for 88 % of the production quantity (range of -6 % and +33 %).

The environmental impacts of Perla OP95 and Sierra Solara products are potentially overrated. In contrast, THERMATEX Perla OP1 products are potentially underrated (+30 to +70 % except for ODP).

7. Requisite evidence

7.1 Radioactivity

Not applicable for these products.

7.2 Biopersistence

The mineral wool used for the production of the panels is biosoluble and, according to *EU Regulation 1272/2008/EC*, is to be assessed as free of suspected cancer. "*EUCEB*" organization monitors and guarantees the quality of the wool used.
The production and use of non-exempt fibres is prohibited by the *Ordinance on Hazardous Substances* and the *Chemicals Prohibition Ordinance*.

7.3 VOC emissions

Measuring point: *Eurofins Product Testing A/S*
Test report: VOC emission test report Indoor Air Comfort GOLD (10.02.2021)
Number: 392-2020-00519911_A_EN rev 1
Testing period: 17.11.2020-11.02.2021
Test basis: *ISO 16000-6, EN 16516*

AgBB Overview (28 days)

Name	Value	Unit
TVOC (C6 - C16)	0,028	mg/m3
TSVOC (C16 - C22)	< 0,005	mg/m3
R (dimensionless)	0,0048	
VOC without NIK	0,021	mg/m3
Carcinogenic substances	< 0,001	mg/m3

7.4 Formaldehyde

Measuring point: *Eurofins Product Testing A/S*
Test report: VOC emission test report Indoor Air Comfort GOLD (10.02.2021)
Number: 392-2020-00519911_A_EN rev 1
Testing period: 17.11.2020-11.02.2021
Test basis: *EN 16516*
The product complies with formaldehyde class E1 according to *EN 16516.*

8. References

Standards

DIN 18177
DIN 18177:2012, Mineral tiles manufactured in the factory by the wet felt process - Characteristic values and test methods.

EN 13501-1
DIN EN 13501-1:2019, Classification of construction products and building elements according to their reaction to fire, Part 1: Classification with the results of tests on the reaction to fire of construction products.

EN 13964
DIN EN 13964:2014, Suspended ceilings - Requirements and test methods.

EN 15804
DIN EN 15804:2012+A2:2019, Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products.

EN 16487
DIN EN 16487:2015-02, Acoustics - Test specifications for suspended ceilings - Sound absorption.

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

ISO 354
DIN EN ISO 354:2003-12, Acoustics - Measurement of sound absorption in reverberant rooms.

ISO 717-1
DIN EN ISO 717-1:2013-06, Acoustics - Assessment of sound insulation in buildings and of building elements - Part 1: Airborne sound insulation.

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

ISO 10848-2
DIN EN ISO 10848-2:2006-08, Acoustics - Measurement of airborne and impact sound transmission between adjacent rooms in test stands - Part 2: Application to lightweight components where the connection has a minor influence.

ISO 11654
DIN EN ISO 11654:1997-07, Acoustics - Sound absorbers for use in buildings - Evaluation of sound absorption.

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 16000-6
ISO 16000-6:2011-12, Indoor air contaminants - Part 6: Determination of VOCs in indoor air and test chambers, sampling on Tenax TA®, thermal desorption and gas chromatography with MS/FID.

OHSAS 18001
OHSAS 18001-2007, Certification of occupational safety and health management systems.

Further References

AgBB
Ausschuss zur gesundheitlichen Bewertung von Bauprodukte (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.

AVV, German List of Wastes Ordinance
Regulation on the European Waste List.

Chemicals Prohibition Ordinance
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).

ECHA-candidate list
List of substances of very high concern (SVHC) for authorisation (ECHA Candidate List), 25.06.2020, published under Article 59 (10) of REACH. Helsinki: European Chemicals Agency.

EUCEB
EUCEB, European Certification Board for Mineral Wool Products. Brussels, Belgium.

Eurofins Product Testing A/S
Test report: VOC emission test report Indoor Air Comfort GOLD (10.02.2021), Number: 392-2020-00519911_A_EN rev 1.

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

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, Berlin: Institut Bauen und Umwelt e.V., 2016. www.ibu-epd.com.

Ordinance on Biocide Products
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.

Ordinance on Hazardous Substances
Ordinance on Hazardous Substances, 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).

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. Version 1.8.

PCR: Mineral panels
Institut Bauen und Umwelt e.V. (IBU), 2019. Product Category Rules for Building-Related Products and Services. Part B: Requirements on the EPD for Mineral panels. Version 1.1. 10.12.2018.

REACH
Regulation (EC) No 1907/2006 of the European Parliament and Council from 18 December 2006, Regulation concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH).

Regulation (EU) Nr. 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 Text with EEA relevance.

Regulation (EU) Nr.1272/2008
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, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006.

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