

ENVIRONMENTAL PRODUCT DECLARATION

according to *ISO 14025* and *EN 15804+A2*

Declaration Holder	Warmotech GmbH
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Phonotherm

Warmotech GmbH

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General information

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Program Holder

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Declaration Holder

EPD-WAT-20250516-IBA1-DE

This declaration is based on the product category rules:

Foam plastic insulation materials, August 1, 2021
(PCR reviewed and approved by the Independent
Council of Experts (SVR))

Issue Date

13.03.2026

Valid until

12.03.2031



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Phonotherm

Declaration Holder

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Declared product/declared unit

1 m³ Phonotherm[®]- Structural Panel

Scope:

This document applies to Phonotherm[®] structural panels made from hardened foam scrap materials by Warmotech GmbH, manufactured in Elsterwerda, Germany. This is a declaration for an average product: Phonotherm[®] structural panels made from industrial polyurethane hardened foam scrap materials, based on the declared unit of 1 m³. Data collection for the environmental assessment was conducted on a plant-specific basis using current annual data from 2022.

The product life cycle assessment is therefore representative of Phonotherm[®] panels from Warmotech GmbH. The declaration holder is responsible for the underlying data and its verification. The declaration holder is liable for the underlying information and supporting documentation; the IBU assumes no liability with regard to manufacturer information, life cycle assessment data, and supporting documentation.

The EPD was prepared in accordance with the requirements of EN 15804+A2. Hereinafter, the standard is referred to simply as *EN 15804*.

Verification

The European standard EN 15804 serves as the core PCR	
Independent verification of the declaration and information in accordance with ISO 14025:2011	
☐	internal
☒	external



Dr. Niels Jungbluth,
(Independent verifier)

Product

2.1 Product Description/Product Definition

Phonotherm® are factory-manufactured structural panels made from polyurethane rigid foam (PUR/PIR) scrap material. The material's functional properties include water resistance combined with water vapor permeability, resistance to moisture—thereby preventing rot—as well as insulation and thermal insulation properties.

Phonotherm® offers stability and mechanical strength despite its low weight. The panels are manufactured in a wide variety of dimensions and thicknesses.

The use of this product is subject to the applicable national regulations at the location of use; in Germany, for example, this includes the building codes of the federal states and the technical regulations based on these codes.

2.2 Application

Phonotherm® panels are used as structural panels for both interior and exterior applications. Their extensive range of properties makes this functional material suitable for a variety of applications, such as in windows, glass facades, drywall construction, and metal construction. Phonotherm® panels can be used, among other things, as partition walls in wet and damp areas, as edge banding or trim for doors in wet and damp areas, as window trim profiles and roller shutter boxes, in facade construction, etc.

2.3 Technical Data

The following technical data apply to the product Phonotherm®:

Structural data

Description	Value	Unit
Bulk density	550 - 700 ± 50	kg/m³
Compressive strength at 10% compression according to EN 826	ca. 7000–8100	kPa
Bending tensile strength according to EN 310	7.8–10.5	N/mm²
Rated thermal conductivity	0.090/0.110	W/(mK)
Water vapor diffusion resistance rating according to EN 12088, DIN 4108-3	25	-
Equalizing humidity at 23 °C, 80 %	3	M.-%
Thermal conductivity	0.083/0.10	W/(mK)
Maximum water absorption EN 12091	12/15	Vol.-%

Performance values of the product with respect to its characteristics as specified in the applicable technical regulation (no CE marking).

2.4 Delivery status

Phonotherm® panels are available in the following dimensions:

Standard sizes

- 2400 x 1350 mm or 2400 x 1500 mm
- 3600 x 1350 mm or 3600 x 1500 mm

Thicknesses

- RG 550: from 15 mm to 60 mm
- RG 700: from 10 mm to 50 mm

Additional sizes and thicknesses are available upon request. The product is not subject to the Hazardous Substances Ordinance or other storage and transportation regulations.

2.5 Basic materials/auxiliary materials

The main components of Phonotherm® panels are:

- PUR/PIR rigid foam scrap: approx. 85 mol%
- Polyisocyanate binder: <15 mass %

The product/article/at least one component contains substances from the ECHA list of Substances of Very High Concern (SVHC) eligible for authorization (as of June 25, 2024) in concentrations exceeding 0.1 mass %: no.

The product/article/at least one component contains other CMR substances in Category 1A or 1B that are not on the Candidate List in concentrations exceeding 0.1 mass % in at least one component: no.

Biocidal products have been added to this construction product or it has been treated with biocidal products (it is therefore a treated article within the meaning of the Biocidal Products Regulation (EU) No. 528/2012): no.

2.6 Production

Material Processing

The rigid polyurethane foams used are production residues from industrial polyurethane foaming and are sourced from manufacturers and processors throughout Europe. In the Phonotherm® production process, PUR/PIR residues are recycled as material and compressed into new structural panels. The PUR/PIR waste materials are removed from the storage bins in the specified ratio and transported to the mixing bin. The material is crushed to the required particle size in various mills. The material is stored in silos until it is discharged into the pressing systems. Any PUR/PIR dust generated is collected throughout the production process and later returned to the production line.

Mixing and Dosage

The raw materials are measured out in a continuous mixer in accordance with the subsequent application specifications for Phonotherm®.

Production: Pressing Line

The premixed material is spread onto a conveyor belt using a spreader, pre-compacted, and then fed into the thermal press. There, the material and binder react with each other under heat and pressure in the thermal press, thereby forming the panel into its final shape. A cold press then removes heat from the formed panel, ensuring faster cooling.

Panel Cutting

The finished panels are cut to standard sizes using longitudinal and cross-cut saws. Some of the offcuts are used to build transport pallets on which the finished panels are stacked.

Quality Control

At every stage of the process, the Phonotherm® panels are inspected to ensure they meet the required quality standards. The specified dimensions—length, width, and thickness—are manually checked for compliance with tolerances after each dimensional change. Measuring instruments, such as calipers for thickness measurement, are monitored in-house and calibrated accordingly.

2.7 Environment and Health During Manufacturing

Warmotech GmbH operates a facility for the production of molded parts using polyurethane, which has been approved under the Federal Immission Control Act (BImSchG) and is subject to regulatory monitoring by the State Office for the Environment. Monitoring of harmful environmental impacts, such as noise and dust emissions, is carried out through measurements mandated by the authorities.

Health protection measures beyond the legally mandated occupational safety measures for commercial enterprises are not required during the entire manufacturing process. In the material preparation area, wearing a dust mask is required. Safety gloves must be worn when handling the panels manually. Hearing protection is provided for employees at all workstations.

2.8 Product Processing/Installation

Phonotherm[®] construction panels can be worked with standard woodworking machines and carbide-tipped attachments. The use of a dust extraction system is recommended during processing. In addition to being processed using milling, grinding, and sawing machines, Phonotherm[®] can also be glued, screwed, and drilled. Due to the material properties of Phonotherm[®], the panels can be coated with aluminum, plastics, films, or even liquid coatings, depending on requirements and the intended application. Phonotherm[®] is chemical-resistant, easy to process, and can be laminated or combined with other materials.

2.9 Packaging

The panels are stacked on pallets with transport feet and secured with steel strapping. Each pallet is provided with a shipping document, a protective cover, and edge protection.

2.10 Service Life

Phonotherm[®] structural panels are durable building materials. Their material composition does not change over the course of their service life.

Environment and Health During Use Based on current scientific knowledge, risks to air and soil can be ruled out when the described products are used as intended. Under standard use, in accordance with the intended purpose of the building product, no adverse health effects are known.

2.11 Reference Service Life

According to the German Sustainable Building Assessment System (*BBSR*), the service life of Phonotherm[®] panels can be generally estimated based on the service life of building components, which is > 50 years for external thermal insulation composite systems (Ref. No.: 335.614.25). The RSL is not established in accordance with any specific rules set forth in European product standards and must take into account *ISO 15686:1, -2, -7, and -8*.

2.12 Extraordinary effects

Brand

The Phonotherm[®] plates declared here correspond to the Building material class B2 according to *DIN 4102* or building material class E according to *EN 13501-1*.

Fire Safety

Description	Value
Building material class according to DIN 4102	B2
Building material class according to DIN EN 13501-1	E
Dripping while burning	d0
Smoke emission	s2

Water

No substances hazardous to water are leached out.

Mechanical Destruction

There are no significant environmental impacts resulting from mechanical destruction.

2.13 Post-Use Phase

Once their service life has ended, the dismantled Phonotherm[®] panels can be recycled as material or sent for disposal.

2.14 Disposal

Phonotherm[®] panel scraps collected by material type at the construction site can be returned to the production process. If the above-mentioned recycling option is not feasible, Phonotherm[®] panels are disposed of in accordance with local regulations under waste code 17 06 04 (insulation material, except for that covered by 17 06 01 and 17 06 03) (*Waste Directive*).

2.15 Additional Information

Installation instructions, product data sheets, and other technical information are available for download on the Warmotech website: www.warmotech.com/de

LCA: Calculation Rules

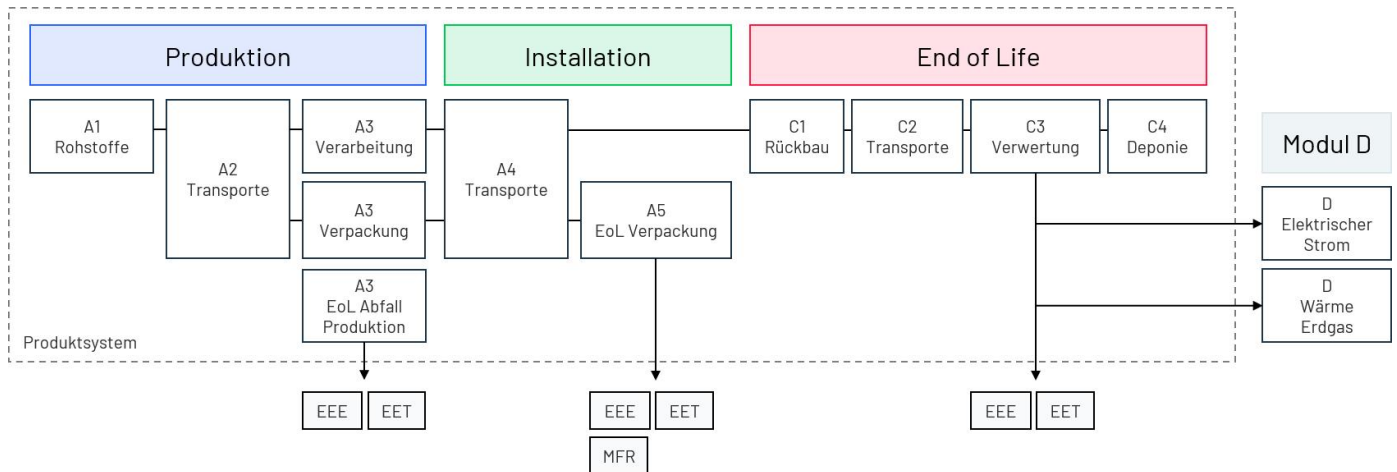
3.1 Declared unit

This declaration pertains to the production of 1 m³ of Phonotherm[®] construction panels by Warmotech GmbH. Average values were calculated based on the quantities produced in Elsterwerda in 2022, Elsterwerda produced weighted according to the proportions of panels available in different bulk densities.

Declared unit

Description	Value	Unit
Declared unit	1	m ³
Bulk density	553.9	kg/m ³
Conversion factor	0.0018053	m ³ /kg

3.2 System boundary



The life cycle assessment considers the system boundary “from cradle to factory gate, with options, modules C1–C4, and module D (A1–A3 + A4 + A5 + C + D)” and follows the modular structure specified in EN 15804. The life cycle assessment includes the following modules:

- A1 (Raw Material Procurement): Procurement of intermediate products and auxiliary materials. The PUR/PIR residues enter the system as industrial waste free of charge.
- A2 (Transport): Transport of intermediate products, auxiliary materials, and packaging to the manufacturing site.
- A3 (Manufacturing): Processing of raw materials and production of Phonotherm panels (including energy consumption); delivery of packaging. Thermal disposal (including transport) of the production auxiliary material Teflon-glass fabric.
- A4 (Transport to the Construction Site): In the absence of specific data, a flat-rate transport distance of 100 km to the point of use was assumed.
- A5 (Installation): The resulting packaging materials are thermally recycled. Steel strapping is recycled as material.
- C1 (Demolition): Manual demolition of the panels.
- C2 (Transport): Transport for disposal/recovery. A distance of 60 km was assumed, based on the assumption of regional disposal of construction waste.
- C3 (Waste Treatment): Thermal recovery in a waste-to-energy plant (WTE).
- C4 (Disposal): Not relevant (since complete thermal recovery).
- D (Credits): The energy-related environmental benefits (electricity and heat) resulting from the thermal recovery of the binder in Module C3 are reported.

3.3 Estimates and Assumptions

All plant- and process-specific data were provided to the life cycle analyst by the manufacturer. Missing data were supplemented with estimates based on comparable substitutes or on information from secondary data sources. The PUR/PIR production residues from the rigid foam industry are accounted for in the life cycle analysis as uncontaminated secondary materials.

3.4 Truncation Rules

The raw materials used, the energy supplies used, and all production waste were fully recorded as annual data from an operational data collection for the life cycle inventory. For the inputs and outputs considered, the actual transport distances and modes of transport were used. Material and energy flows accounting for less than 1% were also taken into account.

The total of the processes not taken into account represents less than 5% of the impact categories. General resources used for administration or sales were not considered. Therefore, all environmental impacts from these life cycle stages are not included in this life cycle assessment. VOC emissions were not modeled in the life cycle inventory because, in terms of both mass flow and environmental relevance, they fall below the 1% cut-off criteria of DIN EN 15804, and it is methodologically difficult to reliably convert dynamic test chamber concentrations into cumulative lifetime emissions—even as an approximation.

3.5 Background Data

All relevant background data for the life cycle assessment model are sourced from the ecoinvent 3.11 database (system model: cut-off by classification). The life cycle assessment is calculated using the openLCA 2.6 software, applying the current characterization factors for EF 3.1.

3.6 Data Quality

To model the life cycle for the manufacture of Phonotherm[®] panels, data was collected from and used by Warmotech GmbH at its manufacturing plant in Elsterwerda for the production year 2022 (then BOSIG Baukunststoffe GmbH). The primary data is representative of the specified period and was linked to current background data.

A quality assessment was conducted to ensure technological, geographic, and temporal representativeness. The data quality can be classified as satisfactory.

This assessment is based on the annual average production. Since all variants have the same composition and differ only in density, the environmental impacts can be easily converted based on weight (linear scaling). Process-related deviations are negligible in this context.

3.7 Analysis Period

The quantities of raw materials and energy used, as well as the amounts of waste generated, refer to the year 2022. The background database used primarily consists of datasets with a reference period extending through 2024.

3.8 Geographic Representativeness

Country or region in which the declared product system is manufactured, used (if applicable), and treated at the end of its life: Germany

3.9 Allocation

The production of Phonotherm[®] is based on the material recycling of PUR/PIR production residues (waste) from the rigid foam industry that have not yet ceased to be waste at the supplier's facility. The recycling of PU residues is legally regulated in Germany and requires formal waste treatment prior to reuse. To this end, the company holds status as a certified waste disposal facility. In accordance with EN 15804, all upstream life cycle impacts associated with the waste remain within the primary system of origin; co-allocation is not required. The system boundary is defined such that environmental impacts begin immediately following disposal by the initial user and subsequent transport to the Phonotherm[®] production facility. No co-allocations were required, and no processes were modeled that would necessitate multi-input allocation. At the end-of-life (EoL) stage, the Phonotherm[®] panel is thermally recycled, assuming a 100% collection rate. The environmental impacts of incineration are reported in Module C3. The resulting environmental benefits for downstream product systems

—derived from the generated electricity and heat (relative to the binder)—are reported in Module D. For the recovery of production residues (Module A3) and packaging (Module A5), environmental impacts are fully accounted for; however, no downstream environmental benefits are claimed in Module D.

3.10 Comparability

In general, Environmental Product Declaration (EPD) data can only be compared or evaluated if all datasets being compared were created in accordance with *EN 15804*, and if the specific building context and product performance characteristics are fully taken into account. The ecoinvent 3.11 background database (system model: cut-off by classification) was utilized.

LCA: Scenarios and other technical information

Characteristic Product Properties of Biogenic Carbon

The product does not contain any biogenic carbon as defined in *EN 15804+A2 (Section 7.2.5)*. The product life cycle assessment takes into account packaging that contains biogenic carbon.

This includes the use of lumber (9.15 kg/m³), pallets (0.490 kg/m³), and corrugated cardboard (0.95 kg/m³).

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

Description	Value	Unit
Biogenic carbon in the product	-	kg C
Biogenic carbon in the corresponding packaging	4.603	kg C

Note: 1 kg of biogenic carbon is equivalent to 44/12 kg of CO₂.

Use of Secondary Materials (A1)

PUR/PIR residual materials (pre-consumer waste) from the plastics industry are used in production (479 kg/m³).

Electricity Use (A3)

Production calculations were based on a residual electricity mix (medium voltage) for Germany in 2023 (0.821 kg CO₂-eq. / kWh).

Production Waste (A3)

During manufacturing, a small amount of Teflon-glass-fiber film is generated as production waste; this film, used as a thermal barrier during compression, wears out after repeated use and must be replaced regularly. The film is sent for thermal recycling.

Transport to the Construction Site (A4)

For transport to the application site, a flat-rate distance of 100 km for a one-way trip was assumed, which can be scaled accordingly for Module A4 as needed. The data on consumption factors were taken from the respective data set in the ecoinvent 3.11 background database. Average load factors were taken into account, which also include the proportion of empty return trips.

Description	Value	Unit
Transport Distance	100	km
Product transport weight	553.9	kg/m ³
Transport weight Packaging	11.23	kg/m ³

Installation inside the building (A5)

In this scenario, installation is carried out without the use of machinery. Any environmental impacts result primarily from the recycling of packaging materials and the transportation involved.

Description	Value	Unit
Wood for thermal recovery	9.65	kg/m ³
Cardboard for thermal recovery	0,95	kg/m ³
Plastics for thermal recovery	0.63	kg/m ³
Steel for recycling	0.52	kg/m ³
Transport distance to the recovery facility	60	km

Reference Service Life

The reference service life (RSL) could not be determined in accordance with EN 15804 (Section 6.3.3), taking ISO 15686-1 into account. The service life according to the BBSR 2017 table (Code 335.141) is over 50 years; however, this service life must be explicitly distinguished from an RSL value specified in accordance with *ISO 15686*.

Useful life

Description	Value	Unit
Service life (according to BBSR)	≥ 50	a

Ende des Lebensweg (C1–C4)

Description	Value	Unit
Separately collected waste type	553.9	kg
Thermal waste treatment	553.9	kg

For the end-of-life scenario of the products, a collection rate of 100% and material recovery were assumed. For the thermal recovery of the insulation board at the end of life, a waste-to-energy plant process with an R1 value >0.6 is assumed. Emissions from incineration are reported in Module C3, and credits for electricity and heat generation (for the binder) are reported in Module D.

The average transport distances for thermal recovery and disposal were estimated at approximately 60 km.

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

The allocation of credits for downstream product systems (Module D) is limited to the proportional thermal recovery of the binder content. In accordance with the cut-off approach, no environmental benefits may be claimed for the recycled content included.
Energy substitution is calculated using datasets for the German electricity grid mix (electric) and thermal energy generation from natural gas in Europe (thermal).

Description	Value	Unit
Net quantity of binder for recycling	74.46	kg
Thermal energy recovery (binder)	573.35	MJ/m³
Electrical energy recovery (binder)	393.38	MJ/m³

Benefits resulting from the recovery of production waste volumes or transport packaging materials are not declared.

LCA: Results

The following table summarizes the results of the life cycle assessment. The results of the impact assessment do not allow for conclusions regarding endpoints of the impact categories, exceedances of threshold values, safety margins, or risks. Long-term emissions (>100 years) are not considered in the impact assessment. The impact assessment is based on the EF 3.1 evaluation method in accordance with EN 15804.

SPECIFICATION OF SYSTEM BOUNDARIES (X = INCLUDED IN LIFE CYCLE ASSESSMENT; MND = MODULE OR INDICATOR NOT DECLARED; MNR = MODULE NOT RELEVANT)

Production stage			Stage of construction of the structure		Stage of Use							Disposal stage				Credits and charges outside the system limit
Raw material supply	Transport	Production	Transport-manufacturer to the point of use	Installation	Use/Application	Maintenance	Repair	Replacement	Renewal	Energy consumption for building operations	Water usage for building operations	Dismantling/Demolition	Transport	Waste treatment	Removal	Reuse, Recovery, or 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 LIFE CYCLE ASSESSMENT - ENVIRONMENTAL IMPACT according to EN 15804+A2: 1 m³ Phonotherm®

Indicator	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
GWP-total	kg CO ₂ -Äq.	7.27E+02	5.87E+00	1.64E+01	0	2.92E+00	1.5E+03	0	-7.35E+01
GWP-fossil	kg CO ₂ -Äq.	7.4E+02	5.87E+00	7.78E-01	0	2.92E+00	1.5E+03	0	-6.99E+01
GWP-biogenic	kg CO ₂ -Äq.	-1.31E+01	3.59E-03	1.56E+01	0	1.79E-03	1.55E-01	0	-3.52E+00
GWP-luluc	kg CO ₂ -Äq.	2.71E-01	2.11E-03	1.4E-04	0	1.05E-03	1.61E-02	0	-6.88E-02
ODP	kg CFC11-Äq.	1.3E-04	1.28E-07	7.86E-09	0	6.38E-08	1E-06	0	-2E-06
AP	mol H ⁺ -Äq.	2.63E+00	1.94E-02	2.72E-03	0	9.66E-03	1.29E+00	0	-1.13E-01
EP-freshwater	kg P-Äq.	2.4E-02	4.5E-05	5E-06	0	2.2E-05	7.6E-04	0	-6.05E-03
EP-marine	kg N-Äq.	8.85E-01	6.52E-03	1.17E-03	0	3.25E-03	7.22E-01	0	-2.7E-02
EP-terrestrial	mol N-Äq.	7.2E+00	7.18E-02	1.25E-02	0	3.57E-02	6.91E+00	0	-3.04E-01
POCP	kg NMVOC-Äq.	2.62E+00	3.08E-02	3.64E-03	0	1.53E-02	1.69E+00	0	-1.12E-01
ADPE	kg Sb-Äq.	4.72E-03	1.7E-05	1E-06	0	8E-06	1.6E-04	0	-8.4E-05
ADPF	MJ	1.25E+04	8.58E+01	5.28E+00	0	4.27E+01	8.53E+02	0	-1.09E+03
WDP	m³ Welt-Äq. entzogen	1.66E+02	4.99E-01	4.67E-01	0	2.48E-01	1.09E+02	0	-9.22E+00

GWP = Global warming potential; ODP = Depletion potential of the stratospheric ozone layer; AP = acidification potential of soil and water; EP = eutrophication potential; POCP = educational potential for tropospheric ozone; ADPE = potential for the depletion of abiotic resources – non-fossil resources (ADP substances); ADPF = potential for the depletion of abiotic resources – fossil fuels (ADP – fossil energy sources); WDP = water withdrawal potential (user)

RESULTS OF THE LIFE CYCLE ASSESSMENT INDICATORS FOR THE DESCRIPTION OF THE USE OF RESOURCES according to EN 15804+A2: 1m³ Phonotherm®

Indicator	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
PERE	MJ	5.09E+02	1.32E+00	1.3E+02	0	6.59E-01	1.77E+01	0	-1.2E+02
PERM	MJ	1.3E+02	0	-1.3E+02	0	0	0	0	0
PERT	MJ	6.39E+02	1.32E+00	1.09E-01	0	6.59E-01	1.77E+01	0	-1.2E+02
PENRE	MJ	1.06E+04	8.58E+01	9.88E+00	0	4.27E+01	2.84E+03	0	-1.09E+03
PENRM	MJ	1.99E+03	0	-4.59E+00	0	0	-1.99E+03	0	0
PENRT	MJ	1.25E+04	8.58E+01	5.28E+00	0	4.27E+01	8.53E+02	0	-1.09E+03
SM	kg	4.79E+02	0	0	0	0	0	0	0
RSF	MJ	0	0	0	0	0	0	0	0
NRSF	MJ	0	0	0	0	0	0	0	0
FW	m³	3.9E+00	1.16E-02	4.6E-03	0	5.77E-03	2.16E+00	0	-2.12E-01

PERE = Renewable primary energy as an energy source; PERM = Renewable primary energy for material use; PERT = Total renewable primary energy; PENRE = non-renewable primary energy as an energy source; PENRM = Non-renewable primary energy for material use; PENRT = Total non-renewable primary energy; SM = Use of secondary materials; RSF = Renewable secondary fuels; NRSF = Non-renewable secondary fuels; FW = Net use of freshwater resources

RESULTS OF THE LIFE CYCLE ASSESSMENT -WASTE CATEGORIES AND OUTPUT FLOWS according to EN 15804+A2: 1 m³ Phonotherm®

Indicator	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
HWD	kg	1.57E+01	8.92E-02	8.45E-02	0	4.44E-02	2.35E+01	0	-5.38E-01
NHWD	kg	6.3E+02	8.27E-01	1.1E+01	0	4.12E-01	6.15E+02	0	-6.85E+00
RWD	kg	8.85E-03	2.4E-05	2E-06	0	1.2E-05	1.9E-04	0	-2.51E-03
CRU	kg	0	0	0	0	0	0	0	0

MFR	kg	0	0	5.15E-01	0	0	0	0	0
MER	kg	0	0	0	0	0	0	0	0
EEE	MJ	6.24E-01	0	2.43E+00	0	0	2.18E+03	0	0
EET	MJ	1.22E+00	0	4.85E+00	0	0	4.27E+03	0	0

HWD = Hazardous waste to landfill; NHWD = Disposed non-hazardous waste; RWD = Disposed radioactive waste; CRU = Components for reuse; MFR = Substances for recycling; MER = Substances for energy recovery; EEE = Exported energy - electric; EET = Exported energy - thermal

RESULTS OF THE LIFE CYCLE ASSESSMENT - additional impact categories according to EN 15804+A2-optional: 1 m³ Phonotherm[®]

Indicator	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
PM	Case of illness	3.2E-05	5.92E-07	4.07E-08	0	2.95E-07	4E-06	0	-4.58E-07
IR	kBq U235-Äq.	1.04E+01	3.54E-02	2.39E-03	0	1.76E-02	2.92E-01	0	-2.06E+00
ETP-fw	CTUe	1.05E+04	1.01E+01	5.08E+00	0	5.01E+00	3.55E+03	0	-1.22E+02
HTP-c	CTUh	4.86E-07	9.66E-10	4.21E-10	0	4.81E-10	1.28E-07	0	-8.68E-09
HTP-nc	CTUh	6E-06	5.55E-08	2.47E-08	0	2.76E-08	4E-06	0	-2.67E-07
SQP	SQP	4.89E+03	8.64E+01	2.75E+00	0	4.3E+01	1.16E+02	0	-8.82E+01

PM = Potential occurrence of diseases due to fine dust emissions; IR = Potential effect due to human exposure to U235; ETP-fw = Potential toxicity comparison unit for ecosystems; HTP-c = Potential toxicity comparison unit for humans (carcinogenic effect); HTP-nc = Potential toxicity comparison unit for humans (non-carcinogenic effect); SQP = Potential soil quality Index

Disclaimer 1 — applies to the indicator “Potential impact from human exposure to U-235.”

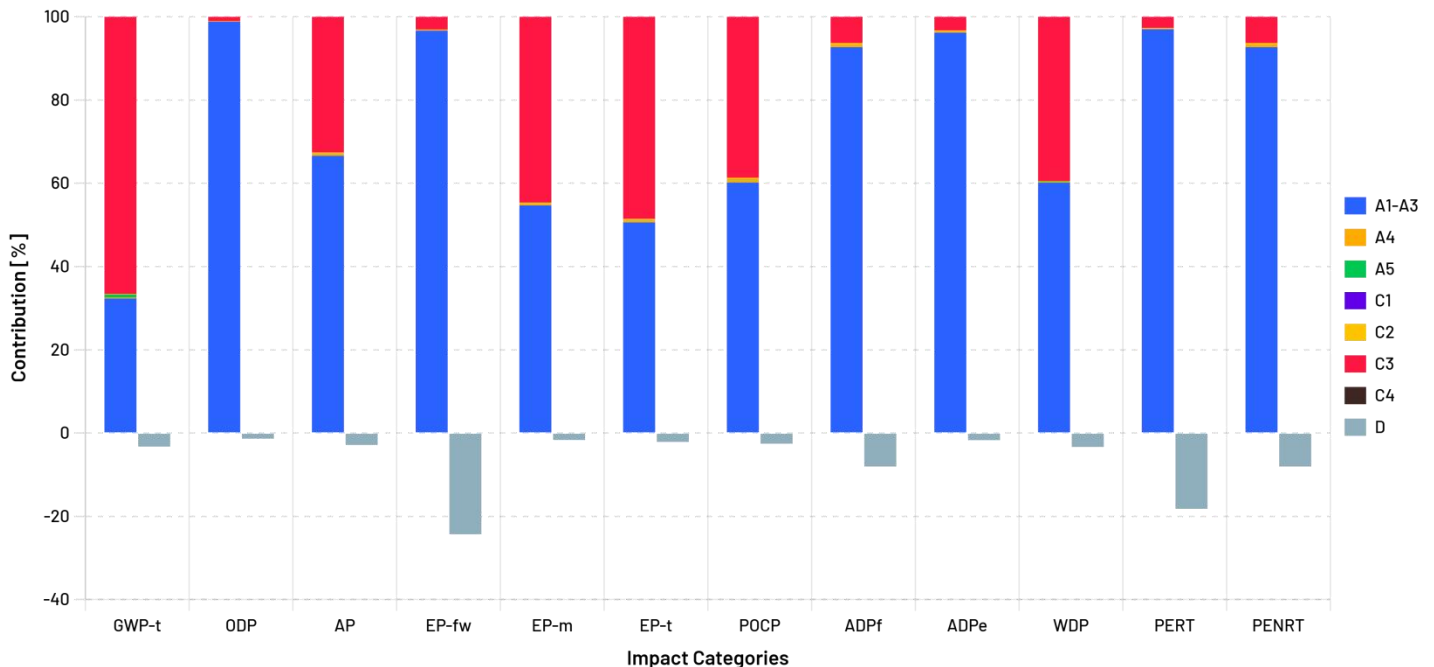
This impact category primarily addresses the potential effects of low-dose ionizing radiation on human health within the nuclear fuel cycle. It does not take into account effects attributable to potential nuclear accidents, occupational exposure, or the disposal of radioactive waste in underground facilities. Nor does this indicator measure potential ionizing radiation emanating from the ground, radon, or certain building materials.

Disclaimer 2 – applies to the indicators: “Potential for abiotic resource scarcity – non-fossil resources,” “Potential for abiotic resource scarcity – fossil fuels,” “Water withdrawal potential (users),” “Potential Toxicity Comparison Unit for Ecosystems,” “Potential Toxicity Comparison Unit for Humans—Carcinogenic Effects,” “Potential Toxicity Comparison Unit for Humans—Non-Carcinogenic Effects,” “Potential Soil Quality Index.”

The results of these environmental impact indicators must be used with caution, as there is a high degree of uncertainty associated with these results or because there is only limited experience with the indicators.

LCA: Interpretation

Relative impact contributions per module (incl. D)



The figure above illustrates the relative contributions of various life-cycle processes and primary energy demand in the form of a dominance analysis.

The impact categories in the life cycle of Phonotherm panels are primarily determined by the global warming potential (GWP). Thermal recovery at the end of life (EoL) accounts for the largest relative contribution at 67%.

Raw material sourcing and manufacturing, at 32%, constitute the second most dominant factor in the entire life cycle. The main driver within production (A1-3) is the binder (MDI), which contributes approximately 42% to the GWP. The second most important factor is the actual manufacturing process, which accounts for 36% of the GWP.

The transportation of PUR residues contributes 22% to the GWP within the production phase (A1-3). Phonotherm panels consist primarily of 86% PUR/PIR waste materials, which are incorporated into the product system as secondary materials without any associated environmental impacts. Despite being used in small quantities, the binder (MDI) and the PTFE film have a significant impact on the EP-fw and ODP indicators. Due to the manual dismantling of the panels, there are no environmental impacts in Module C1. In the present EoL scenario (thermal recovery in C3), there are no environmental impacts associated with landfilling (Module C4).

Supporting Documents

According to the analytical report in accordance with *ISO/IEC 17025* Phonotherm[®] structural panels are REACH-compliant. Tris-chloropropyl phosphate, triethyl phosphate, and phenyl-cresyl phosphate were detected as flame retardants. It was demonstrated that the listed halogenated flame retardants, silicones, hydrochlorobenzene, and volatile organic compounds were not present in significant quantities.

7.1 VOC emissions

The MPA Eberswalde testing laboratory completed the testing procedure for BOSIG Phonotherm[®] structural panels in accordance with the AgBB scheme on November 15, 2017. The following table summarizes the results:

The thermal utilization of the binder (MDI) contained in module C3 and the associated recovery of electricity and thermal energy result in minor advantages for subsequent product systems, which are credited to module D. All other residual materials are completely recycled or disposed of as waste in the respective modules, without any further substitution effects being taken into account for subsequent systems. The results for the different plates can be scaled approximately linearly over the respective plate weight due to the same composition and nature.

Description	Value	Unit
TVOC (3-28 days)	0.28 - 0.16	mg/m ³
SVOC (3-28 days)	<0.005	mg/m ³
VOC without NIK (3-28 days)	0.072 - <0.005	mg/m ³
R (3-28 days)	2.8 - 1	-
Carcinogenic (3-28 days)	<1	µg/m ³
Formaldehyde (3-28 days)	0.003	mg/m ³

The Phonotherm[®] construction plates meet the requirements of the AgBB scheme with regard to measurement after 3 and 28 days.

The test procedure according to the French Décret n° 2011-321 regulation has evaluated Phonotherm[®] construction panels with emission classes A+.

VOC-Emissionen

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