

# ENVIRONMENTAL PRODUCT DECLARATION

in accordance with *ISO 14025* and *EN 15804+A2*

|                          |                                              |
|--------------------------|----------------------------------------------|
| Owner of the declaration | <b>Industrieverband Hartschaum e.V., IVH</b> |
| Publisher                | Institut Bauen und Umwelt e.V. (IBU)         |
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| Issue date               | 15/08/2022                                   |
| Valid until              | 14/08/2027                                   |

EPS hard foam – grey with low bulk density  
preferentially for ETICS and interior insulation

**Industrieverband Hartschaum e.V. (IVH)**

Member of EUMEPS, the association of European  
Manufacturers of Expanded Polystyrene

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## General information

Industrieverband Hartschaum e.V. (IVH)

### Programme holder

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Hegelplatz 1  
D-10117 Berlin  
Germany

### Declaration number

EPD-IVH-20220127-CBG1-DE

### This declaration is based on the following product category rules:

Foam plastic insulation materials, 01.2019  
(PCR tested and approved by the independent advisory board (SVR))

### Issue date

15/08/2022

### Valid until

14/08/2027



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



Dr. Alexander Röder  
(Executive Director Institut Bauen und Umwelt e.V.)

EPS hard foam (grey, bulk density 15 kg/m<sup>3</sup>)

### Owner of the declaration

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### Declared product/Declared unit

The declared unit is 1m<sup>3</sup> of expanded polystyrene hard foam for heat and sound insulation. The average bulk density is 15 kg/m<sup>3</sup>.

### Scope of application:

This EPD describes the grey EPS hard foam products for heat and sound insulation with an average bulk density of 15 kg/m<sup>3</sup>.

The participating member firms represent 90 volume percent of the total number of all IVH member firms in the year 2020.

The owner of the declaration is liable for the basic information and supporting evidence; any liability of the IBU in relation to manufacturer's information, LCA data and supporting evidence is excluded.

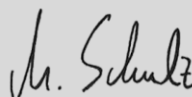
This EPD was compiled in accordance with the requirements of *EN 15804+A2*. This standard is referred to in simplified form as *EN 15804* in the following.

### Verification

European standard *EN 15804* serves as the core PCR

Independent verification of the declaration and statements in accordance with *ISO 14025:2011*

☐ internal ☒ external



Matthias Schulz,  
Independent Verifier

## Product

### Product description/Product definition

This environmental product declaration (EPD) describes grey hard foam insulation products made from expanded polystyrene (EPS) provided by the IVH members. IVH is member of EUMEPS, the association for European Manufacturers of Expanded Polystyrene.

EPS products provided by the IVH members for the heat and sound insulation of buildings.

The insulation materials are factory-made in the form of boards or loose, thermal insulation filler material. This EPD describes the grey, low-bulk density, EPS hard foam products for different fields of application such as façades, preferentially in thermal insulation composite systems (ETICS, External Thermal Insulation Composite Systems). Acting as

heat absorber, the graphite improves the insulation performance substantially.

EPS hard foam is a solid insulation material with a cellular structure which is fabricated from welded, expanded polystyrene or one of its co-polymers. It has a closed-cell, air-filled structure (98% air). EPS boards are rectangular, hard insulation products (cut, moulded or continuously foamed). The board edges can have a rebate edge or tongue and groove. As loose filler material, EPS is factory made in the form of air-filled beads (Ø approx. 6 mm). This environmental product declaration covers the homogeneous EPS insulant without material combination with composite boards or laminated insulation boards.

Essential, characteristic properties are thermal conductivity, bending resistance, and transverse tensile strength.

EU regulation no. 305/2011/ (CPR) applies for placing the product on the market in the EU/EFTA (with the exception of Switzerland). The product requires a declaration of performance based on *DIN EN 13163:2012+A1:2015, Thermal insulation products for buildings – Factory made products of expanded polystyrene (EPS) – Specification*, and the CE label. The respective national regulations apply to its use.

## Application

The primary field of application for the products declared in this document is the **façade insulation with external thermal insulation composite systems (ETICS)**.

The joint *Qualitätsrichtlinien für EPS in WDVS, 2020* define the properties of the EPS boards for thermal insulation composite systems declared herein.

Other applications for products under this environmental product declaration include, according to the application types pursuant to *DIN 4108-10*, table 1: WI, DI, WZ, DZ, WAP, WAB, and DES.

- **WI:** Interior wall insulation
- **DI:** Interior insulation of ceiling (bottom side) or roof, insulation under rafters/supporting structure, suspended ceiling, etc.
- **WZ:** Insulation of double walls, core insulation
- **DZ:** Insulation between rafters, double roof, non-walkable but accessible top floor ceilings
- **WAP:** Exterior, buried insulation of the wall; also for application case 'from below against outside air'; WAP is not for embedding into the soil and for insulant boards in the external thermal insulation composite system (ETICS).
- **WAB:** Exterior wall insulation behind lining; also for application case 'from below against outside air'
- **DES:** Interior insulation of ceiling or ground slab (top side) under screed with sound insulation requirements

## Technical data

The following structural/technical data in as-delivered condition are relevant for the declared ETICS product.

### Constructional data

| Name                                                 | Value               | Unit              |
|------------------------------------------------------|---------------------|-------------------|
| Average bulk density                                 | 15                  | kg/m <sup>3</sup> |
| Design value thermal conductivity acc. to DIN 4108-4 | 0.031 - 0.034       | W/(mK)            |
| Thermal conductivity nominal value acc. to EN 12664  | 0.03 - 0.033        | W/(mK)            |
| Bending resistance acc. to EN 12089                  | >= 0,10;<br>>= 0,15 | N/mm <sup>2</sup> |
| Shearing resistance acc. to EN 12090                 | >= 0.05             | N/mm <sup>2</sup> |
| Shear module acc. to EN 12090                        | >= 1.0              | N/mm <sup>2</sup> |

|                                             |                     |                   |
|---------------------------------------------|---------------------|-------------------|
| Transverse tensile strength acc. to EN 1607 | >= 0.08;<br>>= 0,10 | N/mm <sup>2</sup> |
|---------------------------------------------|---------------------|-------------------|

The products' performance data meet the declaration of performance in relation to its main features in accordance with *DIN EN 13163:2012+A1:2015 Thermal insulation products for buildings – Factory made products of expanded polystyrene (EPS) – Specification*.

Additional, voluntary information for the product is provided outside of the CE marking.

## Base materials/Ancillary materials

The base polymer product for EPS hard foam is polystyrene (PS). It is fabricated by polymerisation of monomeric styrene using a variety of procedures.

The most used raw material production method is polymerisation in a styrene/water suspension, in which the foaming agent pentane and the graphite are added near the end of the polymerisation process. The PS granulate thus produced is processed into foam in downstream physical processing steps.

The products covered by this declaration are furnished with the flame-retardant polymer-FR. The base material used for insulant production is supplied to the insulant manufacturer in the form of bead-shaped granulate and then physically formed/foamed and reworked.

## Composition of grey expanded polystyrene EPS hard foam

### Proportion in mass percent

Polystyrene granulate: 80-90 %  
 Polymer-FR: 1-5 %  
 Graphite: 3.5-10 %  
 Pentane (in relation to mass percent in the raw material): 5-6 %  
 Recycled material: 0-12 %

The pentane used for foaming is a C5 hydrocarbon. It is broken down during the manufacturing and storage process.

In the production of flame-protected polystyrene granulate, low amounts of a flame retardant are introduced during polymerisation. Polymer-FR is used as flame retardant for the products declared in this EPD. Manufacturers are required to provide evidence for the products. Polymer-FR is a brominated styrene-butadiene copolymer.

1) The product/at least one part product contains substances of the candidate list of the substances of Very High Concern (SVHC) (as of 17 January 2022) eligible for approval above 0.1 mass percent: **no**

2) The product or at least one part product contains further CMR Category 1A or 1B substances which are not on the candidate list in doses above 0.1 mass percent in at least one part product: **no**

3) Biocidal products were added to this building product or it was treated with biocidal products (is it

therefore a processed product as provided for in the EU Biocide Product Directive no. 528/2012): **no**

## Manufacture

The manufacture of EPS hard foam follows the process steps pre-foaming, interim storage, foam filling:

In the pre-foaming step, the bead-shaped granulate which holds the foaming agent is softened with overheated water vapour and then expanded by evaporation of the foaming agent. In the next step, the expanded granulate is placed on interim storage in air-penetrable silos. The diffusing air gives the EPS foam particles the stability it needs for the downstream processing steps.

The most used technique for the production of EPS insulant boards is block foaming followed by hot wire cutting.

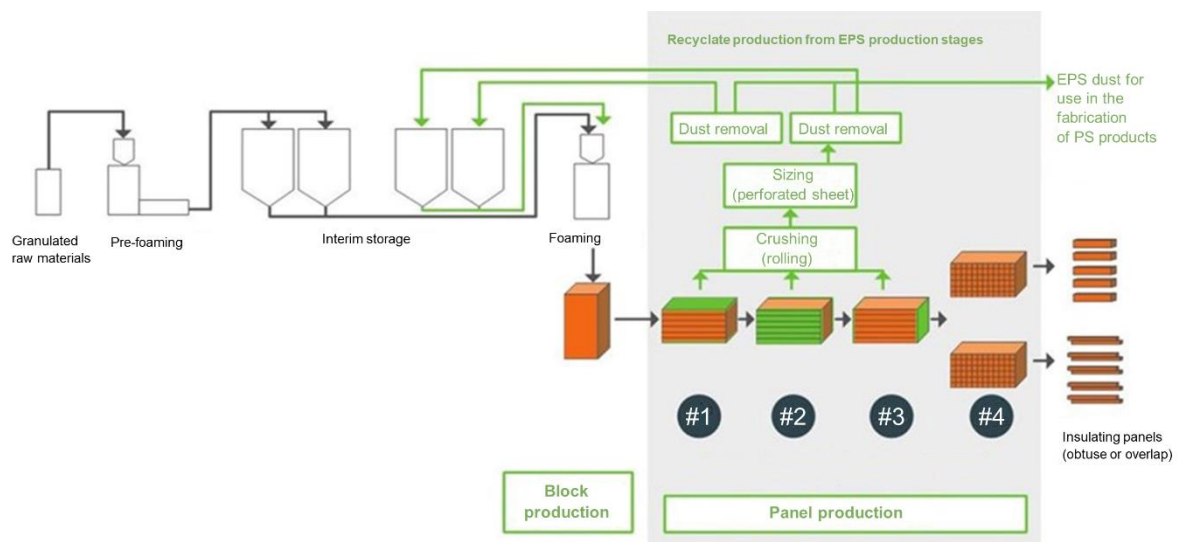
To this end, the pre-foamed and temporarily stored EPS foam particles are filled into cuboidal block moulds and foamed by adding steam at 110°C to 120°C. In addition, recycled material from production divisions and construction site sections are introduced to the process, and the LCA is accounted for in the module A3.

After a brief cooling-down period, the moulds are removed and the blocks are allowed to settle. Next, the blocks are cut into boards in mechanical or thermal cutters. Additional edge profiles (tongue and groove or rebated edge) can be created by milling.

Boards as shaped parts (second most common technique) can be produced with fully automated machines (shaped part machines). In this case, the finished boards have the desired final shape, e.g. rebated without the need of further processing.

In the belt-foaming process (third most common technique), the boards are foamed in a continuous process in a double-belt plant between revolving steel strips. Here, the boards are produced in the desired thickness and length and then cut.

To make the EPS insulant production more sustainable, recycled material from production offcuts or installation residues taken from construction sites are introduced to the raw material proper. Waste is avoided by reusing such offcuts and remains. Therefore, the use of offcuts and remains is not covered in the modules C1-C4 (disposal stage) and D (credits and charges beyond the system boundaries) of this environmental product declaration.



## Environment and health during manufacture

The Technical Rule *TRGS 900* must always be observed for the maximum occupational limit values. Furthermore, no steps beyond the general occupational safety measures are necessary.

EPS hard foam manufacturers are not facilities requiring approval according to *TA Luft*. Additional steps beyond the statutory requirements are not necessary.

In an effort to ensure clean production, the EPS manufacturers within the IVH support the initiative *Operation Clean Sweep*, OCS, a global voluntary initiative of the plastic industry to curtail marine plastic pollution.

The IVH has initiated the *IVH-Initiative Null-Granulatverlust* initiative under the OCS framework which is specifically geared toward logistics and manufacturing processes in the domain of insulant production and to which all IVH members have subscribed.

## Product processing/installation

The EPS products possess excellent processing and machining properties due to their relatively low weight among other factors.

The boards are dimensionally stable and absorb only very little humidity, which is relevant both for the entire life stage of the building and for the construction phase.

All applications must be based on the relevant standards and guidelines (e.g., IVH guidance *EPS zur Verwendung als Sockelplatten in*



*Spritzwasserbereichen* 2020 and technical regulations of the craft associations) and manufacturer instructions. Additional building physical analyses (e.g., moisture proofing) contribute to increased energy efficiency.

The boards for ETICS are installed along the façade and plastered. Where insulation boards must be trimmed on site, hot-wire cutting is recommended. This allows for precise cutting and avoiding unnecessary waste.

Installation is done by gluing, if necessary also by additional mechanical fixing. Application is system-specific, requiring a general type approval which defines the system components and finish.

### Packaging

EPS insulation boards are generally packaged in polyethylene film, protected with cardboard against impact damage, and delivered on wooden pallets. Delivery on EPS bases as an alternative to wooden pallets is common, too. Disposal of the packaging material is done by qualified disposal companies, while the EPS transport bases are recycled.

### Condition of use

The air-filled hard foam possesses very good thermal insulation properties. All materials in the polystyrene used in the manufacture of insulation boards are age and moisture resistant when fitted. The insulation performance and the mechanical properties of EPS hard foam do not change throughout its service life.

### Environment and health during use

EPS insulants have seen use for more than 60 years. They have no known adverse effects on people, animals and the environment.

According to the German Committee for Health-Related Evaluation of Building Products (*AgBB-Schema*), EPS insulants are suitable for interior applications.

### Reference period of use

EPS hard foam-based insulants have an unlimited service life when handled and used properly, without any performance losses.

Limits on service life are only imposed by the service life of the building components and systems which contain EPS. These service lives can be found in the *BBSR table "Nutzungsdauern von Bauteilen zur Lebenszyklusanalyse nach Bewertungssystem Nachhaltiges Bauen (BNB)"* of the Federal Institute for Research on Building, Urban Affairs and Spatial Development within the portfolio of the Federal Office for Building and Regional Planning (BBSR). Hence, EPS hard foam-based thermal insulation composite systems have a service life of 40 years. In all other building thermal insulation applications, the service life of EPS hard foam is  $\geq 50$  years.

### Extraordinary influences

#### Fire protection

The EPS hard foam boards declared in this EPD are flame-retardant, do not form burning droplets; building material class B1 acc. to *DIN 4102-1*.

| Name                                            | Value                 |
|-------------------------------------------------|-----------------------|
| Building material class according to DIN 4102-1 | B 1 - flame retardant |
| Burning drops                                   | no burning droplets   |
| EURO class according to DIN EN 13501-1          | E                     |

### Water

EPS hard foam is chemically neutral, insoluble in water, and does not release water-soluble substances which may contaminate the ground water, rivers, and seas.

Thanks to their closed cellular structure, insulation materials made from EPS hard foam may generally be left in the existing structure even in high moisture conditions. The insulation performance remains largely the same.

### Mechanical destruction

Data on the behaviour of the product, including possible environmental implications in the event of unpredicted mechanical destruction, are irrelevant.

### End-of-life phase

EPS hard foam can be reused or recycled at the end of its service life.

Seeing that, owing to EPS's high durability, only very little EPS insulant waste will accrue now and in the future when buildings are dismantled, EPS recycling will mainly rely on leftovers from insulant production. This was taken into account when calculating the ecological metrics of manufacture. Clean installation offcuts returned from the construction sites to the EPS manufacturer for recycling are not included in the calculation of the ecological metrics.

Under certain boundary conditions, it is also possible to fabricate insulation boards from recycling material. Besides, ground recycling material can be used as lightweight aggregate for mortar, concrete and screed. It also serves as additive for Styrofoam lightweight concrete, insulation plasters, lightweight plasters, and the clay industry.

In principle, EPS waste can also be utilised for manufacturing new EPS raw materials. By dissolving the hard foam insulant and separation of the polystyrene from extraneous material via flocculation, the polystyrene can be recovered as raw material. The processes are controlled via the "Creasolve procedure" and performed with the PolyStyrene-Loop-Initiative of the European EPS industry at industrial scales (*PolyStyreneLoop-Leitfaden* 2020). This type of utilisation has not yet been included in the LCA data calculation because too little waste is obtained for recycling, due to EPS's long service life. The standard scenario for a subsequent use continues to be thermal recycling.

## LCA: Calculation rules

### Declared unit

1 m<sup>3</sup> EPS hard foam with 15 kg/m<sup>3</sup> bulk density.

### Declared unit

| Name          | Value | Unit              |
|---------------|-------|-------------------|
| Declared unit | 1     | m <sup>3</sup>    |
| Bulk density  | 15    | kg/m <sup>3</sup> |

EPD manufacturer groups: Declaration of a specific product, averaged over several plants and several manufacturers.

The average is formed after weighting of the volume-specific total production quantities of the declared products of the member firms.

As to the variation width, deviations were low with 3 % maximum for the use of the main formula constituent polystyrene granulate. Depending on the manufacturer, formulations used different portions of radiation absorber of up to 10 %. Energy requirement variability rather large, due to the different operating parameters and production-related differences. The contributions of power and thermal energy consumption to the overall result, however, are below 15% in most effect categories so that the influence of these variations is rather limited.

### System boundary

EPD type: from the cradle to the factory gate with options, modules C1-C4 and module D (A1-A3 + C + D and additional modules).

The EPD covers the following life cycle stages:

### Product stage (A1-A3):

- A1 Raw material provision and processing; working processes of secondary materials serving as input (e.g., recycling processes),

- A2 transport of the raw materials to the factories (reference territory Germany),
- A3 factory production of EPS hard foam, (incl. energy supply, water supply, supply of ancillary materials, supply of recycling material from production and construction side offcuts, production waste disposal, packaging material production).

### Construction process stage (A5):

- A5 Installation: only disposal of packaging, other installation operations are not accounted for.

### End-of-life stage (C1-C4): End-of-life scenario: 100% thermal recycling

- C1 manual disassembly without operations relevant to LCA,
- C2 road transport (50 km) to waste treatment. Distance may be adjusted at the building level (e.g., if the effective transport distance is 100 km: multiplication of the LCA values with the factor 2),
- C3 100% thermal recycling of the EPS hard foam,
- C4 no other requirements due to landfilling/disposal.

### Credits and charges beyond the system boundaries (D):

Module D comprises: energetic recovery potentials resulting from end-of-life cycle thermal recycling of the packaging and EPS hard foam.

### Comparability

A comparison or the evaluation of EPD data is principally only possible if all data sets to be compared were compiled in accordance with *EN 15804* and the building context or product-specific performance characteristics are included.

The background data were taken from the GaBi database (*GaBi software*).

## LCA: Scenarios and further technical information

### Characteristic product properties

#### Biogenic carbon

The product itself does not contain any biogenic carbon; only the transport packaging does in the form of wooden pallets and cardboard. When calculating a building LCA, it should be noted that the amount of biogenic CO<sub>2</sub> of this packaging bound in Module A1-A3 is subtracted out in Module A5 (installation in building).

### Information to describe the biogenic carbon content at the factory gate

| Name                                  | Value | Unit |
|---------------------------------------|-------|------|
| Biogenic carbon in product            | 0     | kg C |
| Biogenic carbon in relevant packaging | 0.03  | kg C |

The following technical information is the basis for the declared modules or can be used for the development of specific scenarios in the context of a building assessment if no modules are declared (MND).

### Installation into the building (A5)

A5 only covers packaging disposal; other installation requirements (e.g., clippings) are not accounted for.

### End-of-life (C1-C4)

| Name                    | Value | Unit |
|-------------------------|-------|------|
| As mixed building waste | 15    | kg   |
| For energy recovery     | 15    | kg   |

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

Module D comprises: energetic recovery potentials resulting from end-of-life cycle thermal recycling of the packaging and EPS hard foam. A waste incineration plant with an R1 value of > 0.6 was taken as a basis.

## LCA: Results

The following tables show the results of the indicators of the impact assessment, resource utilisation, waste, and other output flows in relation to **1 m³ EPS hard foam (grey) with 15 kg/m³ bulk density**.

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

| Production stage    |           |             | Construction process stage          |          | Use stage       |             |        |             |               |                        |                       | End of life stage         |           |                 |          | Credits and charges beyond the system boundary |
|---------------------|-----------|-------------|-------------------------------------|----------|-----------------|-------------|--------|-------------|---------------|------------------------|-----------------------|---------------------------|-----------|-----------------|----------|------------------------------------------------|
| Raw material supply | Transport | Manufacture | Transport from the gate to the site | Assembly | Use/Application | Maintenance | Repair | Replacement | Refurbishment | Operational energy use | Operational water use | Deconstruction/Demolition | Transport | Waste treatment | Disposal | 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           | ND                                  | X        | ND              | ND          | MNR    | MNR         | MNR           | ND                     | ND                    | X                         | X         | X               | X        | X                                              |

### RESULTS OF THE LCA – ENVIRONMENTAL IMPACT in accordance with EN 15804+A2: 1 m³ EPS hard foam (grey) with 15 kg/m³ bulk density

| Core indicator | Unit                     | A1-A3    | A5       | C1      | C2       | C3       | C4      | D         |
|----------------|--------------------------|----------|----------|---------|----------|----------|---------|-----------|
| Total GWP      | [kg CO <sub>2</sub> eq.] | 5.86E+1  | 3.79E-1  | 0.00E+0 | 4.53E-2  | 5.04E+1  | 0.00E+0 | -2.09E+1  |
| GWP fossil     | [kg CO <sub>2</sub> eq.] | 5.84E+1  | 2.59E-1  | 0.00E+0 | 4.49E-2  | 5.04E+1  | 0.00E+0 | -2.08E+1  |
| GWP biogenic   | [kg CO <sub>2</sub> eq.] | 1.39E-1  | 1.19E-1  | 0.00E+0 | 1.67E-4  | 2.77E-3  | 0.00E+0 | -9.56E-2  |
| GWP luluc      | [kg CO <sub>2</sub> eq.] | 3.41E-2  | 1.83E-5  | 0.00E+0 | 2.89E-4  | 5.52E-4  | 0.00E+0 | -1.26E-2  |
| ODP            | [kg CFC11 eq.]           | 5.56E-13 | 1.67E-16 | 0.00E+0 | 1.15E-17 | 6.55E-15 | 0.00E+0 | -2.08E-13 |
| AP             | [mol H <sup>+</sup> eq.] | 1.35E-1  | 7.09E-5  | 0.00E+0 | 3.88E-5  | 6.75E-3  | 0.00E+0 | -2.53E-2  |
| EP fresh water | [kg P eq.]               | 6.17E-5  | 2.44E-8  | 0.00E+0 | 9.25E-8  | 9.03E-7  | 0.00E+0 | -2.39E-5  |
| EP marine      | [kg N eq.]               | 3.13E-2  | 1.80E-5  | 0.00E+0 | 1.21E-5  | 1.15E-3  | 0.00E+0 | -7.43E-3  |
| EP terrestrial | [mol N eq.]              | 3.42E-1  | 3.30E-4  | 0.00E+0 | 1.46E-4  | 3.16E-2  | 0.00E+0 | -7.98E-2  |
| POCP           | [kg NMVOC eq.]           | 7.02E-1  | 4.88E-5  | 0.00E+0 | 3.32E-5  | 3.10E-3  | 0.00E+0 | -2.10E-2  |
| ADPE           | [kg Sb eq.]              | 7.00E-6  | 2.30E-9  | 0.00E+0 | 3.91E-9  | 9.40E-8  | 0.00E+0 | -3.15E-6  |
| ADPF           | [MJ]                     | 1.43E+3  | 1.52E-1  | 0.00E+0 | 5.96E-1  | 7.38E+0  | 0.00E+0 | -3.59E+2  |
| WDP            | [m³ world eq. deprived]  | 5.99E+0  | 3.94E-2  | 0.00E+0 | 1.75E-4  | 4.08E+0  | 0.00E+0 | -1.39E+0  |

Key

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

### RESULTS OF THE LCA – INDICATORS TO DESCRIBE THE USE OF RESOURCES in accordance with EN 15804+A2: 1 m³ EPS hard foam (grey) with 15 kg/m³ bulk density

| Indicator | Unit | A1-A3   | A5       | C1      | C2      | C3       | C4      | D        |
|-----------|------|---------|----------|---------|---------|----------|---------|----------|
| PERE      | [MJ] | 6.76E+1 | 9.24E-1  | 0.00E+0 | 3.46E-2 | 1.60E+0  | 0.00E+0 | -7.14E+1 |
| PERM      | [MJ] | 8.83E-1 | -8.83E-1 | 0.00E+0 | 0.00E+0 | 0.00E+0  | 0.00E+0 | 0.00E+0  |
| PERT      | [MJ] | 6.85E+1 | 4.12E-2  | 0.00E+0 | 3.46E-2 | 1.60E+0  | 0.00E+0 | -7.14E+1 |
| PENRE     | [MJ] | 8.61E+2 | 4.40E+0  | 0.00E+0 | 5.96E-1 | 5.77E+2  | 0.00E+0 | -3.59E+2 |
| PENRM     | [MJ] | 5.74E+2 | -4.25E+0 | 0.00E+0 | 0.00E+0 | -5.70E+2 | 0.00E+0 | 0.00E+0  |
| PENRT     | [MJ] | 1.44E+3 | 1.52E-1  | 0.00E+0 | 5.96E-1 | 7.38E+0  | 0.00E+0 | -3.59E+2 |
| SM        | [kg] | 4.38E-1 | 0.00E+0  | 0.00E+0 | 0.00E+0 | 0.00E+0  | 0.00E+0 | 0.00E+0  |
| RSF       | [MJ] | 0.00E+0 | 0.00E+0  | 0.00E+0 | 0.00E+0 | 0.00E+0  | 0.00E+0 | 0.00E+0  |
| NRSF      | [MJ] | 0.00E+0 | 0.00E+0  | 0.00E+0 | 0.00E+0 | 0.00E+0  | 0.00E+0 | 0.00E+0  |
| FW        | [m³] | 2.82E-1 | 9.36E-4  | 0.00E+0 | 3.08E-5 | 9.58E-2  | 0.00E+0 | -6.98E-2 |

Key

PERE = Renewable primary energy as energy carrier; PERM = Renewable primary energy as material utilisation; PERT = Total use of renewable primary resources; PENRE = Non-renewable primary energy as energy carrier; PENRM = Non-renewable primary energy as material utilisation; PENRT = Total use of non-renewable primary energy resources; SM = Use of secondary materials; 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 in accordance with EN 15804+A2: 1 m³ EPS hard foam (grey) with 15 kg/m³ bulk density

| Indicator | Unit | A1-A3   | A5       | C1      | C2       | C3      | C4      | D        |
|-----------|------|---------|----------|---------|----------|---------|---------|----------|
| HWD       | [kg] | 1.59E-7 | 3.29E-11 | 0.00E+0 | 2.49E-11 | 1.55E-9 | 0.00E+0 | -7.91E-8 |
| NHWD      | [kg] | 3.53E+0 | 2.80E-2  | 0.00E+0 | 9.62E-5  | 3.06E-1 | 0.00E+0 | -1.59E-1 |
| RWD       | [kg] | 9.53E-3 | 4.99E-6  | 0.00E+0 | 5.72E-7  | 1.96E-4 | 0.00E+0 | -2.29E-2 |
| CRU       | [kg] | 0.00E+0 | 0.00E+0  | 0.00E+0 | 0.00E+0  | 0.00E+0 | 0.00E+0 | 0.00E+0  |
| MFR       | [kg] | 0.00E+0 | 0.00E+0  | 0.00E+0 | 0.00E+0  | 0.00E+0 | 0.00E+0 | 0.00E+0  |
| MER       | [kg] | 0.00E+0 | 0.00E+0  | 0.00E+0 | 0.00E+0  | 0.00E+0 | 0.00E+0 | 0.00E+0  |
| EEE       | [MJ] | 0.00E+0 | 6.26E-1  | 0.00E+0 | 0.00E+0  | 7.76E+1 | 0.00E+0 | 0.00E+0  |
| EET       | [MJ] | 0.00E+0 | 1.44E+0  | 0.00E+0 | 0.00E+0  | 1.79E+2 | 0.00E+0 | 0.00E+0  |

Key

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

**RESULTS OF THE LCA – Additional impact categories in accordance with EN 15804+A2-optional:  
1 m<sup>3</sup> EPS hard foam (grey) with 15 kg/m<sup>3</sup> bulk density**

| Indicator | Unit                                                                                                                                                                                                                                                                                                                                                                              | A1-A3   | A5       | C1      | C2       | C3       | C4      | D        |
|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|----------|---------|----------|----------|---------|----------|
| PM        | [Cases of illness]                                                                                                                                                                                                                                                                                                                                                                | 1.44E-6 | 7.12E-10 | 0.00E+0 | 2.43E-10 | 4.22E-8  | 0.00E+0 | -2.19E-7 |
| IRP       | [kBq U235 eq.]                                                                                                                                                                                                                                                                                                                                                                    | 9.80E-1 | 4.61E-4  | 0.00E+0 | 5.44E-5  | 1.81E-2  | 0.00E+0 | -3.76E+0 |
| ETP-fw    | [CTUe]                                                                                                                                                                                                                                                                                                                                                                            | 7.51E+2 | 5.63E-2  | 0.00E+0 | 4.95E-1  | 2.88E+0  | 0.00E+0 | -6.64E+1 |
| HTP-c     | [CTUh]                                                                                                                                                                                                                                                                                                                                                                            | 1.77E-8 | 4.78E-12 | 0.00E+0 | 9.79E-12 | 2.92E-10 | 0.00E+0 | -3.32E-9 |
| HTP-nc    | [CTUh]                                                                                                                                                                                                                                                                                                                                                                            | 7.65E-7 | 4.28E-10 | 0.00E+0 | 4.83E-10 | 1.01E-8  | 0.00E+0 | -1.32E-7 |
| SQP       | [-]                                                                                                                                                                                                                                                                                                                                                                               | 5.39E+1 | 4.43E-2  | 0.00E+0 | 1.87E-1  | 2.02E+0  | 0.00E+0 | -4.89E+1 |
| Key       | PM = Potential Occurrence of Diseases due to Particle Emissions; IR = Potential Effects of 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 |         |          |         |          |          |         |          |

Restriction notice 1 – applies to the “Potential effects of human exposure to U235” indicator. This effect category mainly deals with the possible effect of low-dose ionising radiation on human health in the nuclear cycle. It does not take into account effects which are attributable to possible nuclear accidents and occupational exposure, or to the disposal of radioactive waste in underground facilities. The potential ionising radiation emanating from the soil, from radon and from some building materials is also not measured by this indicator.

Restriction notice 2 – applies to the indicators: “Abiotic depletion potential for non-fossil resources”, “Abiotic depletion potential for fossil resources”, “Water withdrawal potential (user)”, “Potential toxicity comparison unit for ecosystems”, “Potential toxicity comparison unit for humans – carcinogenic effect”, “Potential toxicity comparison unit for humans – non-carcinogenic effect”, “Potential soil quality index”. The results of this environmental impact category must be applied with care, as uncertainties with these results are high or because there is a lack of experience with the indicator.

EPS is generally radon-free.

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DIN 4102-1:1998-05, Fire behaviour of building materials and building components – Part 1: Building materials; concepts, requirements and tests.

#### DIN 4108-4

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#### DIN 4108-10

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#### EN 13163

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#### EN 13501-1

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#### EN 15804

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

#### ISO 14025

DIN EN ISO 14025:2011-10, Environmental labels and

declarations – Type III environmental declarations – Principles and procedures.

### Laws and regulations

#### EWC

European Waste Catalogue (EWC) of 10th December 2001 (Federal Legal Gazette I p. 3379), last amended by article 1 of the ordinance of 30 June 2020 (Federal Legal Gazette I p. 1533).

#### BBSR table

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## Further documents

### EPS Cycle

Industrieverband Hartschaum, 2021.

### EPS zur Verwendung als Sockelplatten in Spritzwasserbereichen, 2021

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