Statement of Verification

BREG EN EPD No.: 000580 Issue 01

This is to verify that the

Environmental Product Declaration

provided by:

Engineered Foam Products Limited

is in accordance with the requirements of:

EN 15804:2012+A2:2019

and

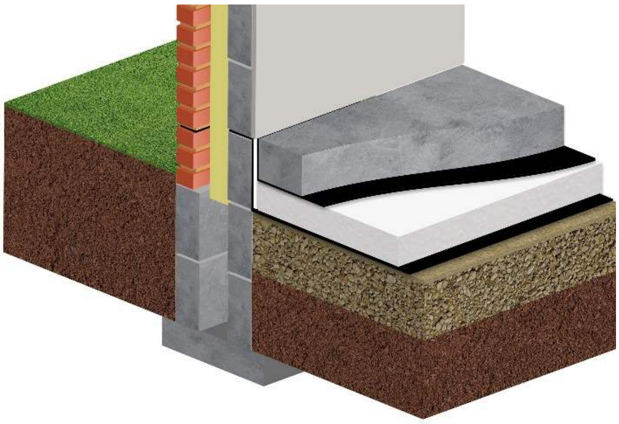
BRE Global Scheme Document SD207

This declaration is for:

1m^3 of EPS with an average density of 23.5 kg/m^3

Company Address

Engineered Foam Products Limited,
Northampton Plant,
Cornhill Close,
Lodge Farm Industrial Estate,
Northampton,
NN5 7UB



Signed for BRE Global Ltd	Emma Baker Operator	03 May 2024 Date of this Issue
03 May 2024 Date of First Issue		02 May 2029 Expiry Date

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Environmental Product Declaration

EPD Number: 000580

General Information

EPD Programme Operator	Applicable Product Category Rules
BRE Global Watford, Herts WD25 9XX United Kingdom	BRE Environmental Profiles 2023 Product Category Rules for Type III environmental product declaration of construction products to EN 15804+A2 PN 514 Rev 3.1
Commissioner of LCA study	**LCA consultant/Tool**
Engineered Foam Products Limited, Northampton Plant, Cornhill Close, Lodge Farm Industrial Estate, Northampton, NN5 7UB	LCA Consultant: Bala Subramanian Tool: BRE LINA A2
Declared/Functional Unit	**Applicability/Coverage**
1m^3 of EPS with an average density of 23.5 kg/m^3	Product Average.
EPD Type	**Background database**
Cradle to Gate with options	Ecoinvent 3.8

Demonstration of Verification
CEN standard EN 15804 serves as the core PCR [a]
Independent verification of the declaration and data according to EN ISO 14025:2010 ☐Internal ☒ External
(Where appropriate [b])Third party verifier: Roger Connick
a: Product category rules b: Optional for business-to-business communication; mandatory for business-to-consumer communication (see EN ISO 14025:2010, 9.4)

Comparability
Environmental product declarations from different programmes may not be comparable if not compliant with EN 15804:2012+A2:2019. Comparability is further dependent on the specific product category rules, system boundaries and allocations, and background data sources. See Clause 5.3 of EN 15804:2012+A2:2019 for further guidance

Information modules covered

Product			Construction		Use stage							End-of-life				Benefits and loads beyond the system boundary
					Related to the building fabric					Related to the building						
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Raw materials supply	Transport	Manufacturing	Transport to site	Construction – Installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction demolition	Transport	Waste processing	Disposal	Reuse, Recovery and/or Recycling potential
☑	☑	☑	☑	☑	☐	☐	☐	☐	☐	☐	☐	☑	☑	☑	☑	☑

Note: Ticks indicate the Information Modules declared.

Manufacturing site(s)

Engineered Foam Products Limited
Northampton Plant,
Cornhill Close,
Lodge Farm Industrial Estate,
Northampton,
NN5 7UB

Construction Product:

Product Description

Expanded Polystyrene (EPS) is a high-performance thermal insulation. The insulation materials are factory-made in the form of boards or loose, thermal insulation filler material. This EPD describes the low-bulk density, EPS hard foam products for use in Construction & Civil Engineering applications. This would include External Thermal Insulation Composite Systems.

EPS hard foam is a solid insulation material with a cellular structure which is fabricated from, 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 compression, thermal conductivity, bending resistance.

Applications:
EPS insulation is ideal for both new builds and upgrading the thermal performance of existing floors, walls & roofs. It provides a cost-effective way of reducing CO_2 emissions and complying with Building Regulations/Standards for U-value requirements.

Thermal Performance:
Engineered Foam Products flooring insulation boards have a thermal conductivity ranging from 0.038 W/mK to 0.030 W/mK depending on the grade and whether it is white or enhanced grey EPS. The thermal conductivity values for each grade are shown in the table overleaf.

Floor Loadings:
The correct grade of EPS should be specified to withstand the calculated floor loadings. Typically, EPS 70, 100 and 130 are used in domestic applications. EPS 100 and above are used in commercial & industrial floors. Compressive strength figures are provided in the table overleaf.

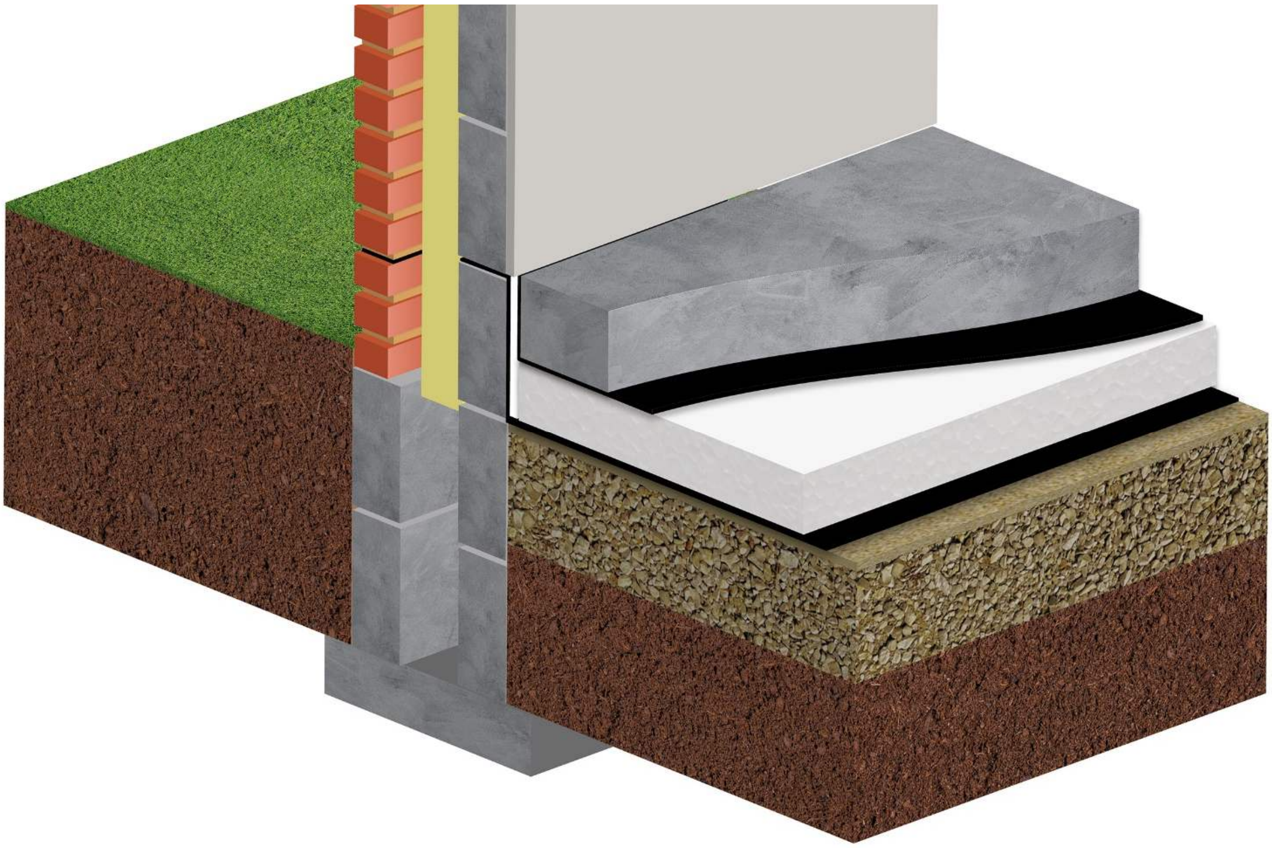
Dimensions:
Engineered Foam Products flooring insulation boards are available in the following typical sizes:
Width: 1200mm
Length: 2400mm
Thickness: 25mm, 50mm, 75mm, 100mm, 150mm* we can supply up to 1400mm thick if required

The EPS blocks will be manufactured as full blocks and then cut down into different thicknesses according to the customer's requirements. In terms of design mix 99% of the EPS blocks are made up of EPS beads. Therefore, in this LCA analysis, an average density of 23.5 kg/m3 has been used and the end-user table has been provided (page -15 of the EPD) with the calculation to enable the impacts of the other EPS with the different thickness and densities.

Technical Information

Physical Properties BS EN13163:2016	EPS 70	EPS 100	EPS 150	EPS 70 Grey	EPS 100 Grey
Thermal Conductivity (W/mK) (Lambda 90/90)	0.038	0.036	0.034	0.030	0.030
Length Tolerance	L2	L2	L2	L2	L2
Width Tolerance	W2	W2	W2	W2	W2
Thickness Tolerance	T2	T2	T2	T2	T2
Flatness Tolerance	P5	P5	P5	P5	P5
Squareness	S1	S1	S1	S1	S1
Bending Strength (kPa)	115	150	200	115	150
Fire Classification	Euroclass E	Euroclass E	Euroclass E	Euroclass E	Euroclass E
Water Vapour Permeability (mg Pa.h.m)	0.015 - 0.030	0.009 - 0.02	0.009 - 0.020	0.015 - 0.030	0.009 - 0.020
Dimensional Stability	DS (N) 5	DS (N) 5	DS (N) 5	DS (N) 5	DS (N) 5
Compressive Strength at 10% (kPa)	70	100	150	70	100
Compressive Strength at 1% (kPa)	20	45	70	20	45
Nominal Density (kg/m3)	15	20	25	15	20

Note: Technical properties of all products assessed within this average EPD. More information can be found in https://www.engineeredfoamproducts.com/wp-content/uploads/2022/11/EFP-Technical-Datasheet_EWI_0922_v2.pdf



Main Product Contents

Material/Chemical Input	%
Expanded Polystyrene	99-100
Pentane	<1

Note: Main product contents of all products assessed within this average EPD

Manufacturing Process

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

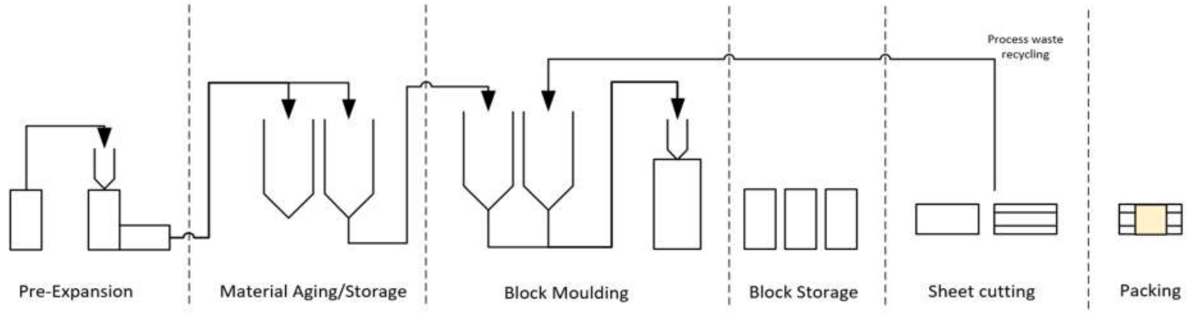
In the pre-foaming step, the bead-shaped granulate which holds the foaming agent is softened with overheated water vapour and then expanded by evaporation of the foaming agent. In the next step, the expanded granulate is placed on interim storage in air-penetrable silos. The diffusing air gives the EPS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

The most used technique to produce 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.

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 Hot wire cutting.

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.

Process flow diagram



Installation:

The EPS products are most commonly laid on a prepared ground substrate, then concrete or cementitious screeds placed directly on top of the EPS.

The key sequence for installation is:

- Cut and lay the product with close, staggered cross-joints over a floor, butting up against the perimeter wall.
- Cut edges of boards shall be laid at a wall perimeter, service pipe or threshold.

The product can be laid in a single or double layer, avoiding gaps and voids. Where a double layer is employed, each layer shall be staggered to the other end through-joints shall be avoided. Spreader boards shall be used to protect the product during laying. Although the product can withstand light foot traffic, care should be taken not to walk over the installed product. If a temporary working platform is required, the product shall be covered with a suitably rigid board. When wheelbarrow is used, planks shall be placed to spread the wheel load. Spot boards shall be used when tipping and shovelling.

Where a concrete slab is laid over the product, perimeter edge strips shall be cut and placed around the floor edges, taped at the joints to prevent cold bridging. These shall be of sufficient depth to fully separate the concrete slab from the walls. To avoid damage to the product, a structural concrete topping should be laid as soon as possible after the boards have been installed.

End of Life

At the end of its life, the EPS beads will be manually removed from the deconstruction unit without the use of any power tools. The recovered EPS beads will then undergo incineration. Given the high calorific value of polystyrene (46 MJ/kg), EPS products can be incinerated at the end of their life cycle. Municipal waste incinerators equipped with energy recovery units can harness the energy embedded in EPS boards for steam and electricity generation, as well as district heating purposes. (British Plastic Federation,2024).

Life Cycle Assessment Calculation Rules

Declared / Functional unit description.

1m^3 of EPS with an average density of 23.5 kg/m^3.

System boundary

This is a cradle to gate with options LCA of EPS manufactured by Engineering foam products manufactured in the United Kingdom. It follows the modular design defined in EN15804:2012+A2:2019 and BRE 2023 Product Category Rules (PN 514 Rev 3.1).

Data sources, quality and allocation

EPS foam products are available in different thicknesses ranging from 25mm, 50mm, 75mm, 100mm, and 150mm, up to 1400mm thick if required. Generally, the EPS beads fused together in a large “Block Moulder” – typically 2460 x 1250 x 1250mm. Once the blocks have been made & cured – they are then cut into sheets from this block to meet the Customers requirements. Sheets come from that block will be the same density for every sheet.
The density of the blocks is dependent on the volume of bead that is pushed into the Block Moulder – the greater the volume of bead the denser the block and in turn the denser the resulting sheets. However, the primary composition of the EPS is the same throughout all product variants, and they all follow the same production process. Therefore, in this EPD, the average density of 23.5 kg/m3 has been selected as a declared unit used to conduct an LCA analysis. Additionally, an end-user guidance table has been provided to enable the assessment of impacts for the thicknesses used in the construction sector.

The quantity used in the data collection for this EPD is the total quantity of EPS manufactured during the data collection period (01/01/22-31/12/22). The original data collection form has been used while doing an LCA analysis, there was a no uplift in the given data. Engineered Foam Products manufacturing unit manufactures other products in addition to the EPS, so the allocation of electricity, gas, and water has been required. Allocation by mass has been used to calculate the input energy flows (electricity and natural gas), and water and waste flows per selected products according to the provisions of the BRE PCR PN514 and EN 15804. The manufacturing site processes include shape moulding and block moulding, with EPS blocks being produced through the block moulding process. The amount of natural gas used for the block moulding process is 59.46%, and the quantity allocated to the amount of natural gas used for EPS130 manufacturing is 28%. Therefore, the allocation is based on the calculated gas usage, which works out to 28% of the site's gas usage.. Electricity consumption has been calculated at 40.8% of the total tonnage, which may overstate the actual usage. Additionally, an assumption has been made regarding the wastewater leaving the site: it is assumed that 95% of the water leaving the site is wastewater, while 5% is consumed for general purposes and product production.

The manufacturing of EPS is through the lean production process, so there will be very low chances of waste from the production, and the manufacturer also confirmed that there was no production waste during the data collection period. Secondary data has been obtained for all other upstream and downstream processes that are beyond the control of the manufacturer (i.e., raw material production) from the ecoinvent 3.8 database. All ecoinvent datasets are complete within the context used and conform to the system boundary and the criteria for the exclusion of inputs and outputs, according to the requirements specified in EN15804.

ISO14044 guidance. **Quality Level**	**Geographical representativeness**	**Technical representativeness**	**Time representativeness**
Very Good	Data from area under study.	Data from processes and products under study. Same state of technology applied as defined in goal and scope (i.e., identical technology).	n/a
Very Good	n/a	n/a	There is approximately 1-2 years between the Ecoinvent LCI reference year, and the time period for which the LCA was undertaken.

For the LCA analysis, specific UK and European data have been selected from the Ecoinvent LCI for the life cycle assessment. Manufacturer uses the UK national grid electricity and natural gas for production, so therefore the most recent consumption mix has been used for the LCA modelling (Ecoinvent 3.8). The GWP carbon footprint for using 1 kWh of electricity, GB (2022) kWh is 0.239 kgCO2e/kWh and for the UK natural gas carbon footprint for using 1 kWh is 0.232 kgCO2eq. The quality level of time representativeness is also Very Good as the background LCI datasets are based on ecoinvent v3.8 which was compiled in 2021. Therefore, there is less than 5 years between the ecoinvent LCI reference year and the time period for which the LCA was undertaken.

Cut-off criteria

All raw materials and energy input to the manufacturing process have been included, except for pentane emissions to air, water, and soil, which are not measured. During the expansion process, some of the pentane escapes over time, with most of it being released during the production process, while a portion remains in the product and escapes during its service life. Although the quantity of pentane used in the expansion process is very small, therefore the pentane emission to air is not accounted in the LCA analysis. The inventory process in this LCA includes all data related to raw material, packaging material and consumable items. Process energy, water use, and discharge are included, except the production waste.

LCA Results

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Parameters describing environmental impacts			GWP-total	GWP-fossil	GWP-biogenic	GWP-luluc	ODP	AP	EP-freshwater
			kg CO_2 eq	kg CO_2 eq	kg CO_2 eq	kg CO_2 eq	kg CFC11 eq	mol H^+ eq	kg $(PO_4)^{3-}$ eq
Product stage	Raw material supply	A1	8.87E+01	8.80E+01	7.32E-01	1.84E-04	9.89E-07	3.01E-01	2.59E-03
	Transport	A2	3.81E+00	3.80E+00	3.24E-03	1.49E-03	8.80E-07	1.54E-02	2.45E-04
	Manufacturing	A3	2.47E+01	2.46E+01	8.81E-02	6.33E-03	2.43E-06	2.74E-02	1.31E-03
	Total (Consumption grid)	A1-3	1.17E+02	1.16E+02	8.24E-01	8.01E-03	4.29E-06	3.44E-01	4.14E-03
Construction process stage	Transport	A4	9.42E-01	9.41E-01	8.02E-04	3.70E-04	2.18E-07	3.82E-03	6.06E-05
	Construction	A5	1.34E+01	1.33E+01	5.81E-02	5.71E-04	3.04E-07	2.47E-02	2.96E-04
100% - Incineration with energy recovery									
End of life	Deconstruction, demolition	C1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Transport	C2	1.96E-01	1.95E-01	1.66E-04	7.67E-05	4.52E-08	7.93E-04	1.26E-05
	Waste processing	C3	7.39E+01	7.39E+01	5.77E-03	1.43E-04	4.93E-08	8.33E-03	7.90E-05
	Disposal	C4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-3.51E+01	-3.49E+01	-5.80E-02	-4.78E-02	-2.37E-06	-1.09E-01	-5.59E-03

GWP-total = Global warming potential, total;
GWP-fossil = Global warming potential, fossil;
GWP-biogenic = Global warming potential, biogenic;
GWP-luluc = Global warming potential, land use and land use change;
ODP = Depletion potential of the stratospheric ozone layer;
AP = Acidification potential, accumulated exceedance; and
EP-freshwater = Eutrophication potential, fraction of nutrients reaching freshwater end compartment

LCA Results (continued)

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Parameters describing environmental impacts			EP-marine	EP-terrestrial	POCP	ADP-mineral &metals	ADP-fossil	WDP	PM
			kg N eq	mol N eq	kg NMVOC eq	kg Sb eq	MJ, net calorific value	m^3 world eq deprived	disease incidence
Product stage	Raw material supply	A1	4.57E-02	4.89E-01	2.62E-01	9.04E-06	1.95E+03	6.54E+01	3.26E-06
	Transport	A2	4.65E-03	5.08E-02	1.56E-02	1.32E-05	5.75E+01	2.59E-01	3.28E-07
	Manufacturing	A3	1.26E-02	8.99E-02	2.64E-02	3.81E-05	5.04E+02	2.71E+00	1.94E-07
	Total (Consumption grid)	A1-3	6.30E-02	6.29E-01	3.04E-01	6.03E-05	2.51E+03	6.84E+01	3.78E-06
Construction process stage	Transport	A4	1.15E-03	1.26E-02	3.85E-03	3.27E-06	1.42E+01	6.40E-02	8.12E-08
	Construction	A5	4.72E-03	4.71E-02	2.21E-02	4.33E-06	1.76E+02	4.82E+00	2.69E-07
100% - Incineration with energy recovery									
End of life	Deconstruction, demolition	C1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Transport	C2	2.39E-04	2.61E-03	7.99E-04	6.79E-07	2.95E+00	1.33E-02	1.69E-08
	Waste processing	C3	4.24E-03	4.34E-02	1.15E-02	1.44E-06	3.24E+00	5.49E-01	6.40E-08
	Disposal	C4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-2.58E-02	-2.86E-01	-6.99E-02	-9.86E-05	-9.31E+02	-6.65E+00	-5.34E-07

EP-marine = Eutrophication potential, fraction of nutrients reaching marine end compartment;
EP-terrestrial = Eutrophication potential, accumulated exceedance;
POCP = Formation potential of tropospheric ozone;
ADP-mineral&metals = Abiotic depletion potential for non-fossil resources;
ADP-fossil = Depletion potential of the stratospheric ozone layer;
WDP = Water (user) deprivation potential, deprivation-weighted water consumption; and
PM = Particulate matter.

LCA Results (continued)

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Parameters describing environmental impacts			IRP	ETP-fw	HTP-c	HTP-nc	SQP
			kBq U^{235} eq	CTUe	CTUh	CTUh	dimensionless
Product stage	Raw material supply	A1	2.87E-02	8.48E+01	1.52E-08	1.69E-07	1.90E+00
	Transport	A2	2.96E-01	4.49E+01	1.45E-09	4.71E-08	3.95E+01
	Manufacturing	A3	4.80E+00	1.76E+02	4.64E-09	8.25E-08	5.43E+01
	Total (Consumption grid)	A1-3	5.13E+00	3.06E+02	2.13E-08	2.99E-07	9.57E+01
Construction process stage	Transport	A4	7.32E-02	1.11E+01	3.60E-10	1.16E-08	9.78E+00
	Construction	A5	3.60E-01	4.61E+01	2.25E-09	2.75E-08	6.81E+00
100% - Incineration with energy recovery							
End of life	Deconstruction, demolition	C1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Transport	C2	1.52E-02	2.30E+00	7.46E-11	2.42E-09	2.03E+00
	Waste processing	C3	1.69E-02	3.53E+02	1.08E-08	9.35E-08	1.44E+00
	Disposal	C4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-3.27E+01	-4.34E+02	-8.78E-09	-2.50E-07	-3.47E+02

IRP = Potential human exposure efficiency relative to U235;
ETP-fw = Potential comparative toxic unit for ecosystems;
HTP-c = Potential comparative toxic unit for humans;
HTP-nc = Potential comparative toxic unit for humans; and
SQP = Potential soil quality index.

LCA Results (continued)

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Parameters describing resource use, primary energy								
			PERE	PERM	PERT	PENRE	PENRM	PENRT
			MJ	MJ	MJ	MJ	MJ	MJ
Product stage	Raw material supply	A1	1.01E+01	0.00E+00	1.01E+01	1.02E+03	9.09E+02	1.92E+03
	Transport	A2	8.10E-01	0.00E+00	8.10E-01	5.65E+01	0.00E+00	5.65E+01
	Manufacturing	A3	3.14E+01	2.58E-03	3.14E+01	5.26E+02	3.84E+01	5.64E+02
	Total (Consumption grid)	A1-3	4.22E+01	2.58E-03	4.23E+01	1.60E+03	9.47E+02	2.55E+03
Construction process stage	Transport	A4	2.00E-01	0.00E+00	2.00E-01	1.40E+01	0.00E+00	1.40E+01
	Construction	A5	2.96E+00	1.80E-04	2.96E+00	1.11E+02	6.69E+01	1.78E+02
100% - Incineration with energy recovery								
End of life	Deconstruction, demolition	C1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Transport	C2	4.16E-02	0.00E+00	4.16E-02	2.90E+00	0.00E+00	2.90E+00
	Waste processing	C3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Disposal	C4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-1.69E+02	0.00E+00	-1.69E+02	-9.30E+02	0.00E+00	-9.30E+02

PERE = Use of renewable primary energy excluding renewable primary energy 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 resource

LCA Results (continued)

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Parameters describing resource use, secondary materials and fuels, use of water						
			SM	RSF	NRSF	FW
			kg	MJ net calorific value	MJ net calorific value	m^3
Product stage	Raw material supply	A1	0.00E+00	0.00E+00	0.00E+00	1.52E+00
	Transport	A2	0.00E+00	0.00E+00	0.00E+00	6.41E-03
	Manufacturing	A3	3.13E-02	1.16E-04	0.00E+00	8.53E-02
	Total (Consumption grid)	A1-3	3.13E-02	1.16E-04	0.00E+00	1.61E+00
Construction process stage	Transport	A4	0.00E+00	0.00E+00	0.00E+00	1.59E-03
	Construction	A5	2.19E-03	8.10E-06	0.00E+00	1.14E-01
100% - Incineration with energy recovery						
End of life	Deconstruction, demolition	C1	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Transport	C2	0.00E+00	0.00E+00	0.00E+00	3.29E-04
	Waste processing	C3	0.00E+00	0.00E+00	0.00E+00	1.29E-02
	Disposal	C4	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	0.00E+00	0.00E+00	0.00E+00	-1.69E-01

SM = Use of secondary material;
RSF = Use of renewable secondary fuels;
NRSF = Use of non-renewable secondary fuels;
FW = Net use of fresh water

LCA Results (continued)

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Other environmental information describing waste categories					
			HWD	NHWD	RWD
			kg	kg	kg
Product stage	Raw material supply	A1	1.33E+00	1.96E+00	2.42E-05
	Transport	A2	6.34E-02	1.13E+00	3.89E-04
	Manufacturing	A3	2.70E-01	4.98E+00	2.20E-03
	Total (Consumption grid)	A1-3	1.66E+00	8.07E+00	2.61E-03
Construction process stage	Transport	A4	1.57E-02	2.79E-01	9.63E-05
	Construction	A5	1.16E-01	5.81E-01	1.83E-04
100% - Incineration with energy recovery					
End of life	Deconstruction, demolition	C1	0.00E+00	0.00E+00	0.00E+00
	Transport	C2	3.25E-03	5.78E-02	2.00E-05
	Waste processing	C3	0.00E+00	0.00E+00	0.00E+00
	Disposal	C4	0.00E+00	0.00E+00	0.00E+00
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-1.93E+00	-2.68E+01	-8.20E-03

HWD = Hazardous waste disposed;
NHWD = Non-hazardous waste disposed;
RWD = Radioactive waste disposed

LCA Results (continued)

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Other environmental information describing output flows – at end of life								
			CRU	MFR	MER	EE	Biogenic carbon (product)	Biogenic carbon (packaging)
			kg	kg	kg	MJ per energy carrier	kg C	kg C
Product stage	Raw material supply	A1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Transport	A2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Manufacturing	A3	0.00E+00	2.05E-03	1.62E-06	1.09E-01	0.00E+00	5.01E-05
	Total (Consumption grid)	A1-3	0.00E+00	2.05E-03	1.62E-06	1.09E-01	0.00E+00	5.01E-05
Construction process stage	Transport	A4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Construction	A5	0.00E+00	1.43E-04	1.13E-07	7.63E-03	0.00E+00	3.51E-06
100% - Incineration with energy recovery								
End of life	Deconstruction, demolition	C1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Transport	C2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Waste processing	C3	0.00E+00	0.00E+00	2.35E+01	0.00E+00	0.00E+00	0.00E+00
	Disposal	C4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

CRU = Components for reuse;
MFR = Materials for recycling

MER = Materials for energy recovery;
EE = Exported Energy

Scenarios and additional technical information

Scenarios and additional technical information			
Scenario	Parameter	Units	Results
A4 – Transport to the building site	Once the EPS products are manufactured, they will be transported to the construction site inside the UK. The average distance of 241 km has been calculated from the delivery of the EPS product across the UK.		
	Fuel type / Vehicle type	Road transport	16–32-ton lorry
	Distance: Manufacturing unit to customer site	km	241
	Fuel	Litres per km	0.227
	Capacity utilisation (incl. empty returns)	%	26
	Bulk density of transported products	kg/m³	1021.3
A5 – Installation	The EPS products are most commonly laid on a prepared ground substrate, then concrete or cementitious screeds placed directly on top of the EPS. The key sequence for installation is: • Cut and lay the product with close, staggered cross-joints over a floor, butting up against the perimeter wall. • Cut edges of boards shall be laid at a wall perimeter, service pipe or threshold.		
	Installation waste rate for the installation of EPS is 7% according to BRE 2023 Product Category Rules (PN 514 Rev 3.1)		
	EPS Waste – 100% Incineration	kg	1.645
Packaging waste	Strech Wrap – 100% landfill	kg	0.0094
	Bearer's waste – 100% Landfill	kg	0.0068
C1- Deconstruction	At the end of its life, the EPS will be removed manually from the deconstruction unit without using any power tools. Therefore, no impacts are associated with this module. The recovered EPS beads will then undergo incineration for energy recovery.		
C2 – Transportation	50km by road has been modelled for module C2 as a typical distance from the demolition site to the incineration with energy recovery plant site. However, end-users of the EPD can use this information to calculate the impacts of a bespoke transport distance for module C2 if required.	Litres per km	0.227
	Distance: Deconstruction unit to pre-processing unit via Road	km	50
C3 – Pre-processing	Since 100% of the product is sold inside the UK, the current practice for dealing with waste EPS in the UK is incineration with energy recovery therefore, the recovered EPS foam will be sent to an incineration with energy recovery plant without the need for any pre-processing. There are no landfill waste emissions from the C1 or C3 stages, therefore no impacts are attributable to module C4. The 100% incineration with energy recovery scenario assumes that the EPS foam has a calorific value of 46 MJ per kg (British Plastics Federation).	kg/m³	23.5

Scenarios and additional technical information			
Scenario	Parameter	Units	Results
Module D	The EPS foam will be incinerated for energy at end of life. The scenario is assumed at the end of life, the membranes will be incinerated in the UK, so the UK electricity dataset have been selected. The dataset used to calculate the avoided impacts of electricity consumption in a future system was 'Electricity, medium voltage {GB}| market for | Alloc Def, U'. This process is energy-efficient, with 37.4% of the combustion heat recovered after incineration. The efficiency rate of 37.4% has been calculated by taking the weighted average of the number of waste incineration plants available in the UK. According to the Environmental Agency's 2013 article on "CHP Ready Guidance for Combustion and Energy from Waste Power Plants" in the UK, EFW plants have an efficiency of 33%, and CHP plants have an efficiency of 55%. Additionally, according to Azapagic, A., & Jeswani, H. K. (2016), there are currently 25 MSW incinerators with energy recovery in the UK. It is assumed that 20 plants generate heat and power at 33%, while 5 plants generate electricity at 55%. Therefore, the weighted average calculation is used to determine the efficiency, which is calculated at 37.5%. Calorific value of EPS - 46 MJ/kg (British Plastic Federation,2024). 100% Incineration with energy recovery – 23.5 kg/m^3		

Interpretation of results

Since the product is made out of 99% EPS, the bulk of the environmental impacts are attributed to the manufacturing of EPS, covered by information modules A1-A3 of EN15804:2012+A2:2019. During the raw material manufacturing (i.e., A1), the environmental impacts are highest in the following indicators; Depletion potential of the stratospheric ozone layer (ADPF), Use of renewable primary energy resources used as raw materials (PENRE), the use of non-renewable primary energy resources used as raw materials (PENRM), and the Global Warming potential (GWP).

Individual product calculations

The LCA results listed in the tables above are for the 1m3 of EPS with the average density of 23.5 kg/m^3 panels. The end-user of this EPD can therefore use these results to calculate impact profiles for each EPS product with different foam thicknesses by using the weight per m^3. In the below calculation table, the GWP impacts have been calculated for the standard product thicknesses, with results also calculated for 1 kg/m3 as an example to enable calculations for other thicknesses.

	EPS		EPS 70	EPS 100	EPS 150
Kg/m^3	**23.5**	**1**	**15**	**20**	**25**
A1	8.87E+01	3.77E+00	5.66E+01	7.55E+01	9.44E+01
A2	3.81E+00	1.62E-01	2.43E+00	3.24E+00	4.05E+00
A3	2.47E+01	1.05E+00	1.58E+01	2.10E+01	2.63E+01
A1-A3	1.17E+02	4.99E+00	7.48E+01	9.98E+01	1.25E+02

Note: The multiplication table above assumes that 99% of each product will be comprised of EPS and 1% blowing agent

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