epd-norway
Global Program Operator

Environmental Product Declaration

In accordance with 14025 and EN15804 +A2

Styropor S80

EPS Insulation boards

VARTDAL PLAST

Owner of the declaration:
Vartdal Plastindustri AS

Product name:
Styropor S80

Declared unit:
1 m^2 EPS insulation board with 38 mm thickness at R=1 K m^2/W, transportation to site, waste handling and recovery.

Product category /PCR:
EN 15804:2012 + A2:2019 serves as core PCRNPCR 012:2022 Part B for Thermal insulation products, version 2

Program holder and publisher:
The Norwegian EPD foundation

Declaration number:
NEPD-4356-3585-EN

Registration Number:
NEPD-4356-3585-EN

Issue date: 14.04.2023

Valid to: 14.04.2028

The Norwegian
EPD Foundation

General information

Product:
Styropor S80

Program Operator:
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Declaration number:
NEPD-4356-3585-EN

This declaration is based on Product Category Rules:
EN 15804:2012 + A2:2019 serves as core PCR

NPCR 012:2022 Part B for Thermal insulation products, version 2

Statements:
The owner of the declaration shall be liable for the underlying information and evidence. EPD Norway shall not be liable with respect to manufacturer, life cycle assessment data and evidences.

Declared unit with option (cradle-to-gate: A1-A3, A4, C1-C4, D:
1 m^2 EPS insulation board with 38 mm thickness at R=1 K m^2/W, transportation to site, waste handling and recovery.

Functional unit:
N/A

Verification:
Independent verification of the declaration and data, according to ISO14025:2010

internal ☐ external ■

Jane Anderson

Jane Anderson
Independent verifier approved by EPD Norway

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Place of production:
Norway

Management system:
NS-EN ISO 9001, NS-EN ISO 14001

Organisation no:
970890513

Issue date:
14.04.2023

Valid to:
14.04.2028

Year of study:
2020. Update to EN15804:2012+A2:2019 in 2023.

Comparability:
EPDs from other programmes than EPD Norge may not be comparable.

The EPD has been worked out by:
Kristine Bjordal, energy- and environmental consultant at Asplan Viak.

Approved

Håkon Haugen

Manager of EPD Norway

Product

Product description:

Expanded polystyrene (EPS) is a common material used for thermal insulation of buildings, including floors, walls and ceilings. It is a polymer foam, consisting of air-filled polystyrene cells. As 98% of the material is air, EPS provides good insulating properties at a low weight. Other characteristics of the material include low moisture absorption, long service life and high compressive strength.

EPS is manufactured through permeating polystyrene beads with pentane, allowing the beads to expand when exposed to steam. This addition of a so-called blowing agent adds 4% - 6% w/w. The expanded polystyrene (EPS) beads are then fed into a block molding machine, where steam and pressure forms large blocks of EPS. The amount of EPS going into the mould determines the density of the block, where pressure class 80 provides a density at 80 kN/m2, which is approximately 15 kg/m3. After moulding, the remaining blowing agent, pentane, is aired out and the blocks are cut into the desired shape.

Weight per declared unit is approximately 0,57 kg given a density of 15 kg/cubic meter with a thickness of 38 mm

Product specification:

The insulation board is provided in several dimensions and thicknesses. Please use the conversion table below for other sizes than the declared unit.

Variation per declared unit between manufacturing sites <10%. Weighted average applied for raw material transportation to sites. Straight average utilized between sites for producton inputs.

The material usage per declared product is given below:

Material use per declared unit	KG	%
Polystyrene	0,57	95 %
Pentane	0,03	5 %

Technical data:

The technical data of the declared product is given below:

Technical data	
CE marking	EPS insulation boards are CE certified according to NS-EN 13163
Typical size	600 mm x 1200 mm
Thickness	10 mm - 200 mm
Bending strength	>50 kN/m2
Compressive strength	80 kN/m2 (declared unit), see conversion factors for other values
Moisture absorption	<5 vol%
Fire class	F

Conversion factors:

EPS insulation is provided in different densities and thicknesses depending on the intended use. The relationships between density and weight, and between weight and environmental impacts are linear. Results for various densities and thicknesses can be converted based on the following factors (factor * environmental impact):

Compressive strength [kN/m²]	Thickness [mm]		
	38	**50**	**100**
60	0,89	1,2	2,3
80	1	1,3	2,6
100	1,2	1,6	3,1
150	1,6	2,1	4,2
200	1,9	2,5	5
250	2,3	3	6
300	2,6	3,4	6,9
400	3,3	4,3	8,7

Market:

Norway

Reference service life, product:

60 years

Reference service life, building:

60 years

LCA: Calculation rules

Declated unit:

1 m^2 EPS insulation board with 38 mm thickness at R=1 K m^2/W, transportation to site, waste handling and recovery.

Data quality:

General requirements and guidelines concerning the use of generic and specific data and the quality of those are as described in EN 15804: 2012+A2:2019, clause 6.3.6 and 6.3.7., including ISO14044:2006, 4.2.3.6. The data is representative according to temporal, geographical and technological requirements. Databases used have been ecoinvent v3.8 (2022). Upstream data for polystyrene from Plastics Europe (2015). Calculations have been carried out using Simapro v9.

Temporal:

Data for use in module A3 is supplied by the EPD owner and consists of recorded and calculated amounts of specific material and energy consumption. Specific data has been collected for 2019. Generic data has been created or updated within the last 10 years. Any exceptions are documented in the LCA-report.

Geographical:

The product included in this EPD is manufactured in Norway and is representative for the Norwegian market. Best available proximations are used where Norwegian-specific data are unavailable.

Technological:

Data represents technology in use.

Allocation:

The allocation is made in accordance with the provisions of EN 15804. Incoming energy and water and waste production in-house is allocated equally among all products through mass allocation. Effects of primary production of recycled materials allocated to the main product in which the material was used. The recycling process and transportation of the material is allocated to this analysis.

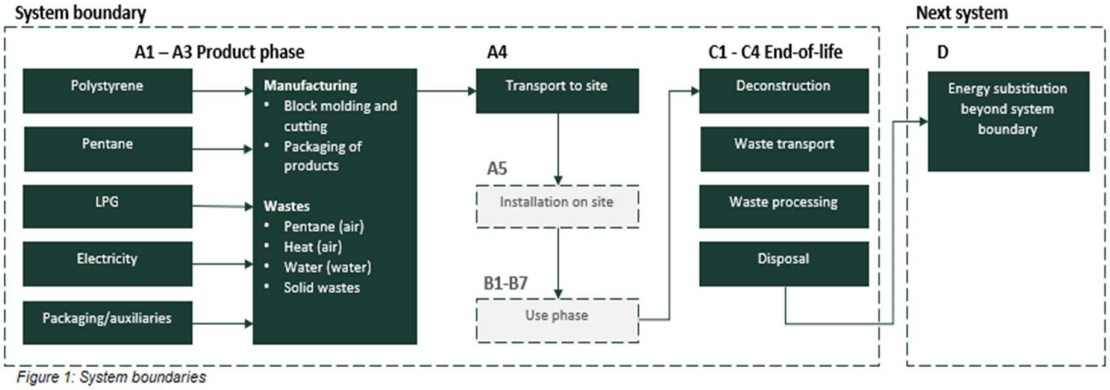

Figure 1: System boundaries

System boundary:

Modules are declared according to NPCR 012 Part B. Declared units include A1-A3, A4, C1-C4, and D and are shown in Figure 1. Gray boxes denote modules not declared.

Cut-off criteria:

All major raw materials and all the essential energy is included. The production process for raw materials and energy flows that are included with very small amounts (<1% energy, mass, impact) are not included. This cut-off rule does not apply for hazardous materials and substances.

LCA: Scenarios and additional technical information

The following information describe the scenarios in the different modules of the EPD.

Scenarios have been developed to account for downstream processes such as demolition and waste treatment in accordance with the requirements of EN 15804 and NPCR 012 Part B.

Transport from production place to assembly/user (A4)

Type	Capacity utilisation (incl. return) %	Type of vehicle	Distance KM	Fuel/Energy consumption	value (l/t)
Truck	4,6 %	100 m^3 jumbo trailer	300	0,19 l/tkm	57,9

The scenario for transportation to building site follows the default scenario provided in NPCR 012 Part B. EPS is a bulky product, resulting in a low capasity utlization.

End of Life (C1, C3, C4)

	Unit	Value
Hazardous waste disposed	Kg	N.R
Collected as mixed construction waste	Kg	N.R
Reuse	Kg	N.R
Recycling	Kg	N.R
Energy recovery	Kg	0,57
To landfill	Kg	0,004

Due to a lack of reliable data for the removal of EPS insulation from buildings, C1 is assumed to not require energy or material inputs. The scenario for end-of-life treatment of collected EPS follows the default conservative scenario provided in NPCR 012 Part B, which is municipal incineration with energy recovery (C3). Ashes and solids after incineration is landfilled (C4). Recovered energy from C3 is assumed to substitute elecricity and district heating (D).

Transport to waste processing (C2)

Type	Capacity utilisation (incl. return) %	Type of vehicle	Distance KM	Fuel/Energy consumption	value (l/t)
Truck	4,3%	90 m^3 box trailer	83	0,19 l/tkm	15,6

The scenario for transportation to waste processing is assumed to be 83 km (Raadal et al., 2009). Insulation is assumed compressed at the waste handling facility. A standard box trailer with a 90 m3 cubic capacity is assumed.

Benefits and loads beyond the system boundaries (D)

	Unit	Value
Substitution of electricty	MJ	1,50
Substitution of district heating	MJ	12,20

The scenario for Module D follows the conservative scenario provided in NPCR 012 Part B. EPS insulation recovered at the end of life is incinerated with energy recovery and substitutes Norwegian elecitricty and district heat mixes.

Additional technical information

No.

LCA: Results

The result is valid for the delared unit, 1 m^2 EPS insulation board with 38 mm thickness at R=1 K m^2/W, transportation to site, waste handling and recovery. How to calculate the LCA result for other pressure classes is shared the section about conversion factors.

System boundaries (X=included, MND= module not declared, MNR=module not relevant)

Product stage			Assembly stage		Use stage							End of life stage				Benefits & loads beyond system boundary
Raw materials	Transport	Manufacturing	Transport	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	X	MNR	MNR	MNR	MNR	MNR	MNR	MNR	MNR	X	X	X	X	X

Core environmental impact indicators

Indicator	Unit	A1-A3	A4	C1	C2	C3	C4	D
GWP-total	kg CO2 eq.	1,81E+00	1,12E-01	0,00E+00	3,19E-02	1,81E+00	3,50E-05	-1,06E-02
GWP-fossil	kg CO2 eq.	1,79E+00	1,12E-01	0,00E+00	3,19E-02	1,81E+00	3,46E-05	-9,29E-03
GWP-biogenic	kg CO2 eq.	1,17E-02	1,11E-04	0,00E+00	3,29E-05	1,37E-04	4,15E-07	-1,25E-03
GWP-LULUC	kg CO2 eq.	1,01E-02	9,83E-06	0,00E+00	2,84E-06	3,03E-06	1,25E-08	-5,35E-05
ODP	kg CFC11 eq.	5,97E-08	2,59E-08	0,00E+00	7,79E-09	1,18E-09	1,58E-11	-3,30E-10
AP	mol H^+ eq.	7,12E-03	3,93E-04	0,00E+00	7,24E-05	2,16E-04	2,75E-07	-3,59E-05
EP-freshwater	kg P eq.	5,89E-05	2,25E-07	0,00E+00	6,55E-08	1,44E-07	5,97E-10	-3,73E-07
EP-marine	kg N eq.	2,00E-03	1,23E-04	0,00E+00	1,31E-05	1,04E-04	9,56E-08	-6,47E-06
EP-terrestrial	mol N eq.	1,84E-02	1,36E-03	0,00E+00	1,46E-04	1,12E-03	1,05E-06	-7,87E-05
POCP	kg NMVOC eq.	2,64E-02	3,84E-04	0,00E+00	5,25E-05	2,67E-04	3,08E-07	-2,11E-05
ADP-M&M	kg Sb eq.	9,22E-07	5,30E-08	0,00E+00	1,51E-08	4,21E-08	1,03E-10	-2,68E-07
ADP-fossil	MJ	5,16E+01	1,58E+00	0,00E+00	4,75E-01	1,42E-01	1,06E-03	-1,58E-01
WDP	m^3	3,41E-01	1,07E-03	0,00E+00	3,03E-04	3,51E-03	3,80E-06	-9,60E-03

GWP-total: *Global Warming Potential;* ***GWP-fossil:*** *Global Warming Potential fossil fuels;* ***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;* ***EP-freshwater:*** *Eutrophication potential, fraction of nutrients reaching freshwater end compartment; See "additional Norwegian requirements" for indicator given as PO4 eq.* ***EP-marine:*** *Eutrophication potential, fraction of nutrients reaching freshwater end compartment;* ***EP-terrestrial:*** *Eutrophication potential, Accumulated Exceedance;* ***POCP****: Formation potential of tropospheric ozone;* ***ADP-M&M****: Abiotic depletion potential for non-fossil resources (minerals and metals);* ***ADP-fossil:*** *Abiotic depletion potential for fossil resources;* ***WDP:*** *Water deprivation potential, deprivation weighted water counsumption*

Additional environmental impact indicators

	Unit	A1-A3	A4	C1	C2	C3	C4	D
PM	Disease incidence	6,63E-08	3,22E-09	0,00E+00	6,83E-10	8,69E-10	5,17E-12	-3,29E-10
IRP	kBq U235 eq.	3,60E-01	6,85E-03	0,00E+00	2,06E-03	2,20E-04	4,53E-06	-3,50E-03
ETP-fw	CTUe	1,21E+02	8,99E-01	0,00E+00	2,68E-01	9,53E+00	1,06E-02	-2,08E-01
HTP-c	CTUh	4,94E-10	1,45E-11	0,00E+00	4,08E-12	7,72E-11	9,07E-13	-1,41E-11
HTP-nc	CTUh	1,09E-08	5,57E-10	0,00E+00	1,43E-10	3,59E-09	3,18E-11	-2,14E-10
SQP	Dimensionless	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00

PM: *Particulate matter emissions;* ***IRP:*** *Ionising radiation, human health;* ***ETP-fw:*** *Ecotoxicity (freshwater);* ***ETP-c:*** *Human toxicity, cancer effects;* ***HTP-nc:*** *Human toxicity, non-cancer effects;* ***SQP:*** *Land use related impacts / soil quality*

Classification of disclaimers to the declaration of core and additional environmental impact indicators

ILCD classification	Indicator	Disclaimer
ILCD type / level 1	Global warming potential (GWP)	None
	Depletion potential of the stratospheric ozone layer (ODP)	None
	Potential incidence of disease due to PM emissions (PM)	None
ILCD type / level 2	Acidification potential, Accumulated Exceedance (AP)	None
	Eutrophication potential, Fraction of nutrients reaching marine end compartment (EP-marine)	None
	Eutrophication potential, Accumulated Exceedance (EP-terrestrial)	None
	Formation potential of tropospheric ozone (POCP)	None
	Potential Human exposure efficiency relative to U235 (IRP)	1
ILCD type / level 3	Abiotic depletion potential for non-fossil resources (ADP-minerals&metals)	2
	Abiotic depletion potential for fossil resources (ADP-fossil)	2
	Water (user) deprivation potential, deprivation-weighted water consumption (WDP)	2
	Potential Comparative Toxic Unit for ecosystems (ETP-fw)	2

	Potential Comparative Toxic Unit for humans (HTP-c)	2
	Potential Comparative Toxic Unit for humans (HTP-nc)	2
	Potential Soil quality index (SQP)	2

Disclaimer 1 – This impact category deals mainly with the eventual impact of low dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator.

Disclaimer 2 – The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator

Resource use

Parameter	Unit	A1-A3	A4	C1	C2	C3	C4	D
RPEE	MJ	1,28E+00	6,82E-03	0,00E+00	1,99E-03	4,72E-03	3,39E-05	-1,61E+00
RPEM	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
TPE	MJ	1,28E+00	6,82E-03	0,00E+00	1,99E-03	4,72E-03	3,39E-05	-1,61E+00
NRPE	MJ	2,72E+01	1,58E+00	0,00E+00	4,75E-01	1,42E-01	1,06E-03	-1,58E-01
NRPM	MJ	2,44E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
TRPE	MJ	5,16E+01	1,58E+00	0,00E+00	4,75E-01	1,42E-01	1,06E-03	-1,58E-01
SM	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
RSF	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
NRSF	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
W	m^3	1,20E-02	4,40E-05	0,00E+00	1,27E-05	5,21E-04	1,18E-06	-1,18E-02

RPEE Renewable primary energy resources used as energy carrier; RPEM Renewable primary energy resources used as raw materials; TPE Total use of renewable primary energy resources; NRPE Non renewable primary energy resources used as energy carrier; NRPM Non renewable primary energy resources used as materials; TRPE 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; W Use of net fresh water

End of life – Waste

Parameter	Unit	A1-A3	A4	C1	C2	C3	C4	D
HW	kg	9,27E-04	3,81E-05	0,00E+00	1,12E-05	1,70E-02	2,53E-06	-2,65E-05
NHW	kg	3,00E-02	2,33E-02	0,00E+00	6,46E-03	9,65E-03	3,68E-03	-9,45E-03
RW	kg	2,61E-05	1,11E-05	0,00E+00	3,35E-06	2,47E-07	7,02E-09	-1,66E-06

HW Hazardous waste disposed; NHW Non hazardous waste disposed; RW Radioactive waste disposed

End of life – output flow

Parameter	Unit	A1-A3	A4	C1	C2	C3	C4	D
CR	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
MR	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
MER	kg	5,83E-03	0,00E+00	0,00E+00	0,00E+00	5,70E-01	0,00E+00	0,00E+00
EEE	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,50E+00	0,00E+00	0,00E+00
ETE	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,22E+01	0,00E+00	0,00E+00

CR Components for reuse; MR Materials for recycling; MER Materials for energy recovery; EEE Exported electric energy; ETE Exported thermal energy

Reading example: 9,0 E-03 = 9,0*10-3 = 0,009

Additional Norwegian requirements

Greenhouse gas emission from the use of electricity in the manufacturing phase

National production mix from import, medium voltage (production of transmission lines, in addition to direct emissions and losses in grid) of applied electricity for the manufacturing prosess(A3).

National electricity grid	Unit	Value
Norwegian electricity, medium voltage	kg CO2 -eq/kWh	0,02542

Additional environmental impact indicators required in NPCR Part A for construction products

In order to increase the transparency of biogenic carbon contribution to climate impact, the indicator GWP-IOBC is required as it declares climate impacts calculated according to the principle of instantaneous oxidation. GWP-IOBC is also reffered to as GWP-GHG in context to Swedish public procurement legislation.

Indicator	Unit	A1-A3	A4	C1	C2	C3	C4	D
GWP-IOBC	kg CO2 eq.	1,81E+00	1,12E-01	0,00E+00	3,19E-02	1,81E+00	3,50E-05	-1,06E-02

GWP-IOBC *Global warming potential calculated according to the principle of instantaneous oxidation.*

Hazardous substances

The declaration is based upon reference to threshold values and/or test results and/or material safety data sheets provided to EPD verifiers. Documentation available upon request to EPD owner.

- ✓ The product contains no substances given by the REACH Candidate list or the Norwegian priority list.

Indoor environment

No tests have been carried out on the product concerning indoor climate - Not relevant.

Carbon footprint

Carbon footprint has not been worked out for the product.

Bibliography

ISO 14025:2010	Environmental labels and declarations - Type III environmental declarations - Principles and procedures
ISO 14044:2006	Environmental management - Life cycle assessment - Requirements and guidelines
EN 15804:2012+A2:2019	Sustainability of construction works - Environmental product declaration - Core rules for the product category of construction products
ISO 21930:2007	Sustainability in building construction - Environmental declaration of building products
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Raadal et al. (2009)	Klimaregnskap for avfallshåndtering. Fase I og II: Glassemballasje, metallemballasje, papir, papp, plastemballasje, våtorganisk avfall, treavfall og restavfall fra husholdninger. ISBN: 82-8035-073-X.

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