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The Norwegian EPD Foundation

ENVIRONMENTAL PRODUCT DECLARATION

in accordance with ISO 14025, ISO 21930 and EN 15804

Owner of the declaration:	Steinull hf.
Program operator:	The Norwegian EPD Foundation
Publisher:	The Norwegian EPD Foundation
Declaration number:	NEPD-1858-803-EN
Registration number:	NEPD-1858-803-EN
ECO Platform reference number:	-
Issue date:	13.09.2019
Valid to:	13.09.2024

Steinull hf. stone wool insulation, density group 75-100 kg/m³

Product

Steinull hf.
Owner of the declaration

STEINULL HF

www.epd-norge.no

General information

Product:
Steinull hf. stone wool insulation, density group 75-100 kg/m³

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Declaration number:
NEPD-1858-803-EN

Place of production:
Sauðárkrókur, Iceland

ECO Platform reference number:

Management system:
ISO 14001, ISO 9001 and EUCEB

This declaration is based on Product Category Rules:
CEN Standard EN 15804 serves as core PCR
NPCR Part A: Construction Products and Services NPCR 012 version 2.0 Part B for Thermal insulation products

Organisation no:
590183-0249 (Icelandic Identity Number)

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

Issue date:
13.09.2019

Valid to:
13.09.2024

Declared unit:
1 m² stone wool with thermal resistance R = 1 K m^2 W^{-1} and a bulk density of 75 - 100 kg/m³.

Year of study:
LCA conducted in 2017-2019. Production data is from 2016/17

Declared unit with option:
-

Comparability:
EPD of construction products may not be comparable if they not comply with EN 15804 and seen in a building context.

Functional unit:
1 m² stone wool with thermal resistance R = 1 K m^2 W^{-1}, a bulk density of 75 - 100 kg/m³ and a reference service life that matches the building lifetime (> 60 years).

The EPD has been worked out by:
Sigurður Thorlacius, EFLA Consulting Engineers

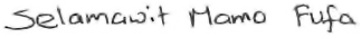
EFLA CONSULTING ENGINEERS

Verification:

The CEN Norm EN 15804 serves as the core PCR. Independent verification of the declaration and data, according to ISO14025:2010

☐ internal ☑ external

Third party verifier:



Selamawit Mamo Fufa, PhD
(Independent verifier approved by EPD Norway)

Approved

Håkon Hauan
Managing Director of EPD-Norway

Product

Product description:

The product is stone wool (mineral wool) made in Iceland from melting basalt and other minerals, spinning and tempering with binders. Stone wool is a construction material mainly used for thermal and acoustic insulation. It is available in various bulk densities with varying thermal conductivity and compressive strength. Stone wool is a firesafe material (A1 according to ÍST EN 13501). The manufacturing plant is located in Sauðárkrókur in the northern part of Iceland. The melting is done with electricity (electric arc furnace) as opposed to burning coke and gas (cupola furnace). The stone wool is ready for use directly after production. None of the products in this product category contain lamination (cover facing).

Product specification:

Materials	[kg/m²]*	[%]
Basalt sand	1,93	71%
Olivine sand	0,34	12%
Other minerals	0,36	13%
Binders	0,09	3%
Total without packaging	2,73	100%
Packaging	0,022	
Pallets	0,114	

* mass composition per decl. unit (1 m² with R = 1 m²K/W)

Technical data:

The stone wool is produced according to ÍST EN 13162:2012+A1:2015.

Bulk density ρ [kg/m³]	Thermal conductivity λ [W/mK]	Thickness [mm] for R = 1 m²K/W	Area density [kg/m²] for R = 1 m²K/W
75 - 100 (average 80,3)	0,034	34	2,73 (av. product)

Market:

Five scenarios: Reykjavík in Iceland (IS), The Faroe Islands (FO), The United Kingdom (UK), mainland Europe (EU) and Oslo in Norway (NO).

Reference service life, product:

Matches the lifetime of the building (> 60 years)

Reference service life, building:

Matches the lifetime of the building (> 60 years)

Products in the considered bulk density product category (75-100 kg/m³) covered by this EPD. End use application abbreviations are explained Appendix E in the LCA report. Multiplication factors are provided to enable users to get product-specific results. It has been confirmed with a variability check that the product-specific impacts attained with a multiplication factor are within ±10% variation from the actual impacts for that product, as required in Part B NPCR 012 version 2.0.

Product	End use application according to ÍST EN 16738	Bulk dens. [kg/m³]	Thermal conductivity [W/mK]	Multiplic. factor*
Plötur 75 (ICEROCK S75)	WZ	75	0,034	0,93
Veggplata	WAB, WAP, WH, WI	80	0,034	0,99
Lamelluplötur	WAP, WAA	100		0,75
Múrplata	WAP	92	0,034	1,15

* To extract environmental data for specific products, the results can be multiplied by the corresponding multiplication factor.

LCA: Calculation rules

Functional unit:

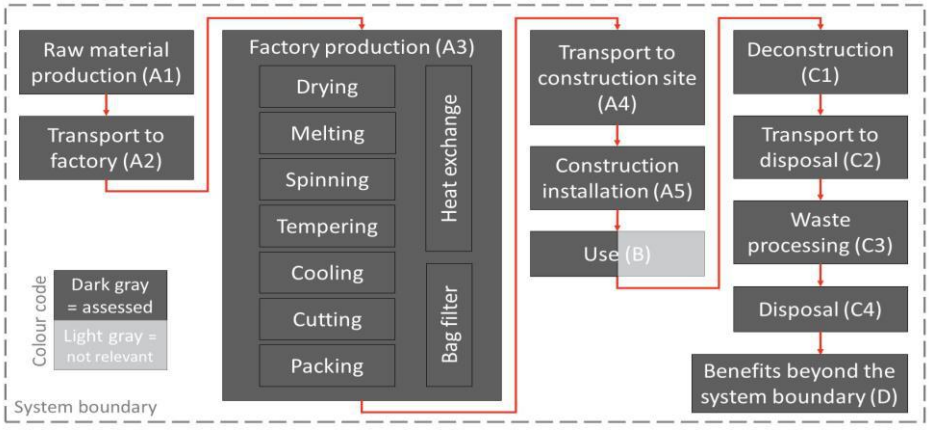
1 m² stone wool with thermal resistance R = 1 K m^2 W^{-1}, a bulk density of 75 - 100 kg/m³ and a reference service life that matches the building lifetime (> 60 years).

The EPD is cradle to grave, see figure below.

System boundary:

The production stage (module A1-A3) covers raw materials production (e.g. basalt sand, shell sand); binder components production (e.g. resin); transport of raw materials to manufacturing plant; product manufacturing (electricity, fuel, emissions); production of packaging materials; waste disposal or treatment until end-of-waste state. Transport to building site (A4) is based on scenarios.

Figure 1. System boundaries for the LCA of stone wool.



The lifetime product matches that of the building (> 60 years) so the whole use stage (B) is assumed to be zero. There are no in situ impacts during installation (A5), except for the waste treatment of plastic packaging. Disassembly requires negligible energy use so module C1 is assumed to be zero. Generally, stone wool is delivered unsorted to landfilling so module C3 is assumed to be zero.

Data quality:
The assessment is based on production data from 2016 that was collected in 2016-2017. Specific data was used for the stone wool manufacturing itself and for raw materials, when available. The international databases from Thinkstep (GaBi Professional 2017 and GaBi Construction materials 2017) and the international Ecoinvent 3.3 database were used for generic background data. All generic background processes have been updated within the last 10 years, as required by ÍST EN 15804, except for the process for polyethylene film (PE-LD). Data for production of phenolic insulation resin was published 9 years ago and is therefore considered as generic.

Cut-off criteria:
All major raw materials and all the essential energy is included. The cut-off criteria of 1% of total mass input required by ÍST EN 15804 was fulfilled in the assessment. The only exluded processes are silane (0.004%).

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.

Averaging of data:
This EPD presents the average impacts for a group of products with a similar bulk density (75-100 kg/m³). All products are factory made and produced by the same producer (Steinull hf.) at the same production site. To extract environmental data for specific products, the results can be multiplied by the corresponding multiplication factor on the previous page. The converted results will then be impact per 1 m² of the product that achieves R = 1 m²k/W.

LCA: Scenarios and additional technical information

The following information describe the scenarios in the different modules of the EPD. Five market scenarios were considered, i.e. Reykjavík in Iceland (IS), The Faroe Islands (FO), The United Kingdom (UK), mainland Europe (EU) and Oslo in Norway (NO). Product transport weight in a 40-feet container was found based on the maximum volume and average bulk density. The capacity utilisation was calculated by dividing the product transport weight either by truck payload or ship deadweight tonnage, taking into account how many containers the ship can carry. For the Norway scenario, the default storage location of Oslo is assumed and the building site is assumed to be also in Oslo, resulting in total 90 km transport from port to building site.

Transport from production place to user (A4)

Type	Cap. utiliz. (incl. rtn.) %	Type of vehicle	Distance km					Fuel/Energy consumption*	Value (l/t)				
			IS	FO	UK	EU	NO		IS	FO	UK	EU	NO
Truck (in Iceland)	20	Truck-trailer 34-40t	285	120	120	120	120	0,050 l/tkm	14	6,0	6,0	6,0	6,0
Container ship	25	Cont. s. 5560 DWT	0	870	1970	2230	2840	0,013 l/tkm	0	11	26	29	37
Truck	20	Truck-trailer 34-40t	0	2	100	100	90	0,050 l/tkm	0	0,1	5,0	5,0	4,5

* Fuel use per ton transported 1 km at the given capacity utilisation.

Assembly (A5)
Stone wool is a light material that requires negligible energy to install. The only relevant impacts in module A5 are waste treatment of plastic packaging (8 kg per ton of stone wool). Transport of waste plastic to Sweden for incineration is included in module A5 but the benefits of energy recovery is in module D.

Use stage (B1-B7)
There is no environmental related impact by the stone wool during service life so B1 is assumed to be zero. The lifetime of the stone wool matches the building lifetime (> 60 years) and modules B2-B5 are therefore assumed to be zero. Modules B6 (operational energy) and B7 (water use) are not relevant for insulation materials by default because they do not use energy during the use phase according to ÍST EN 16783.

End of life stage (C1-C4)
Stone wool is a light material that requires negligible energy during deconstruction and module C1 is therefore assumed to be zero. Stone wool is an inert material and is generally disposed at a landfill in Iceland and waste treatment (C3) is therefore assumed to be zero. It is assumed that the stone wool will be transported to an inert landfill at the End of Life (C4). Different scenarios for this transport (C2) are presented for the market scenarios (Iceland, Faroe Islands, United Kingdom, mainland Europe and Norway).

Transport to waste processing (C2)

Type	Cap. utiliz. (incl. rtn.) %	Type of vehicle	Distance km					Fuel/Energy consumption*	Value (l/t)				
			IS	FO	UK	EU	NO		IS	FO	UK	EU	NO
Truck	20	Truck-trailer 34-40t	20	2	100	100	100	0,050 l/tkm	1,0	0,1	5,0	5,0	5,0

Disposal (C4)

	Unit*	Value
To landfill	kg	2,73

*Per declared unit (1 m² of stone wool with R = 1 m²K/W)

Benefits and loads beyond the system boundaries (D)
Waste plastic packaging is incinerated and the energy recovery benefits of replacing Swedish electricity and steam are considered in module D. The considered end of life scenario for stone wool is disposal so that gives no benefits or loads beyond the system boundaries.

LCA: Results

Overall, the greatest environmental impacts stem from life cycle phases A1 (extraction and manufacturing of raw materials) and A3 (manufacturing of stone wool). Impacts are greater in phase A3 than phase A1 in all impact categories except for the ADP fossil category where impacts are greater for phase A1.

Annual fossil fuel use of the plant is only a minor part of the energy use because electricity is used in the melting process and binder tempering. This very low consumption of fossil fuels is acheived by using the electric arc furnace technology and because the electricity in the Icelandic electricity grid is 100% from renewable sources.

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

Product stage			Assemby stage		Use stage							End of life stage				Beyond the system boundaries
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	X	X	X	X	X	X	MNR	MNR	X	X	X	X	X

Environmental impact

Parameter	Unit	A1 - A3	A4 (EU)	A5	B1-B5	C1, C3	C2 (EU)	C4	D
GWP	kg CO_2 -eqv	1,13E+00	3,83E-01	7,19E-02	0	0	4,09E-02	4,28E-02	-1,98E-02
ODP	kg CFC11-eqv	2,52E-08	5,76E-17	6,73E-18	0	0	1,01E-17	2,36E-16	-4,92E-17
POCP	kg C_2H_4 -eqv	1,07E-03	3,43E-04	3,21E-06	0	0	-6,50E-05	1,87E-05	-1,55E-06
AP	kg SO_2 -eqv	2,50E-02	9,46E-03	5,65E-05	0	0	1,76E-04	2,44E-04	-9,89E-06
EP	kg PO_4^{3-}-eqv	1,93E-03	1,07E-03	6,78E-06	0	0	4,47E-05	2,76E-05	-1,92E-06
ADPM	kg Sb-eqv	5,81E-07	1,51E-08	4,22E-10	0	0	3,59E-09	1,50E-08	-2,51E-09
ADPE	MJ	1,29E+01	4,80E+00	2,93E-02	0	0	5,52E-01	5,69E-01	-3,15E-01

GWP Global warming potential; ODP Depletion potential of the stratospheric ozone layer; POCP Formation potential of tropospheric photochemical oxidants; AP Acidification potential of land and water; EP Eutrophication potential; ADPM Abiotic depletion potential for non fossil resources; ADPE Abiotic depletion potential for fossil resources

Resource use

Parameter	Unit	A1 - A3	A4 (EU)	A5	B1-B5	C1, C3	C2 (EU)	C4	D
RPEE	MJ	5,17E+01	8,35E-02	1,66E-03	0	0	3,29E-02	7,46E-02	-1,52E-01
RPEM	MJ	8,66E-01	0	0	0	0	0	0	0
TPE	MJ	5,25E+01	8,35E-02	1,66E-03	0	0	3,29E-02	7,46E-02	-1,52E-01
NRPE	MJ	7,45E+00	4,82E+00	3,08E-02	0	0	5,54E-01	5,88E-01	-4,52E-01
NRPM	MJ	5,98E+00	0	0	0	0	0	0	0
TRPE	MJ	1,34E+01	4,82E+00	3,08E-02	0	0	5,54E-01	5,88E-01	-4,52E-01
SM	kg	3,66E-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
W	m^3	5,87E-02	1,58E-04	1,52E-04	0	0	1,11E-05	1,48E-04	-2,76E-04

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 (EU)	A5	B1-B5	C1, C3	C2 (EU)	C4	D
HW	kg	1,39E-07	8,78E-08	4,00E-11	0	0	6,16E-09	1,00E-08	-1,38E-10
NHW	kg	1,11E-01	1,33E-04	2,78E-04	0	0	9,34E-06	2,73E+00	-2,39E-04
RW	kg	0	0	0	0	0	0	0	0

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

End of life - Output flow

Parameter	Unit	A1 - A3	A4 (EU)	A5	B1-B5	C1, C3	C2 (EU)	C4	D
CR	kg	3,66E-02	0	0	0	0	0	0	0
MR	kg	3,19E-03	0	0	0	0	0	0	0
MER	kg	1,43E-03	0	2,18E-02	0	0	0	0	0
EEE	MJ	0	0	0	0	0	0	0	0
ETE	MJ	0	0	0	0	0	0	0	0

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

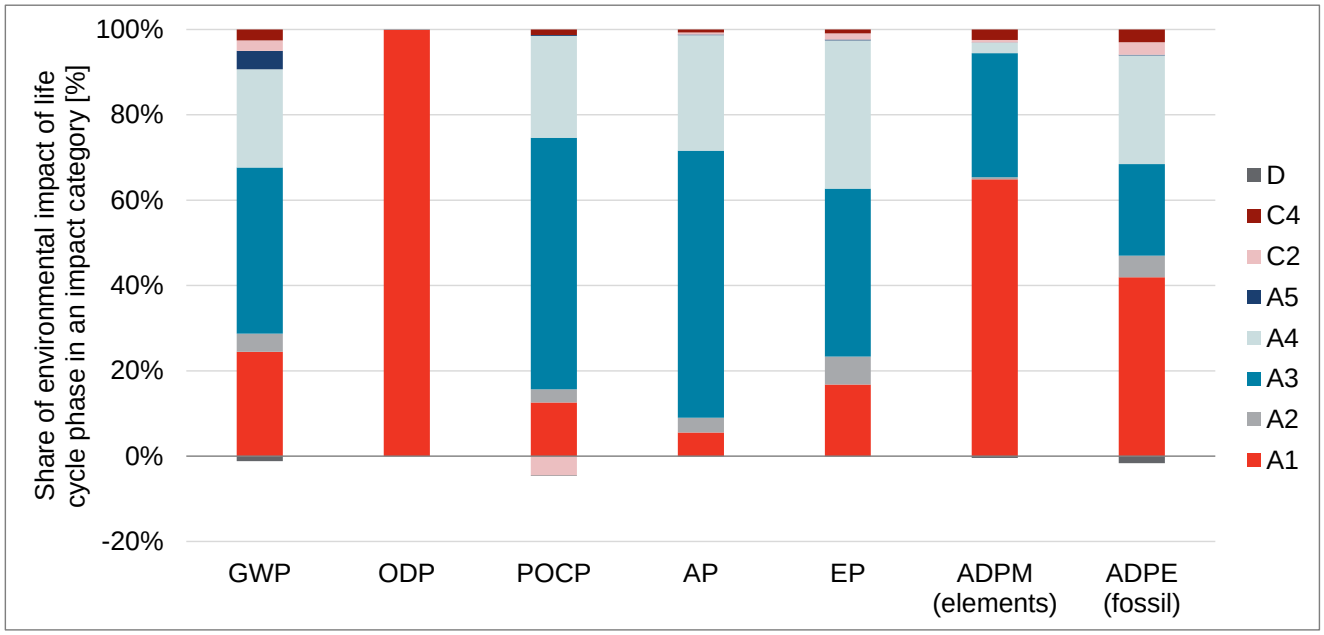


Figure 1 Share of each life cycle phase in the environmental impact of each environmental impact category.

Five alternate market scenarios were considered for transport from factory to user (A4): Transport to Reykjavík in Iceland (IS), transport to The Faroe Islands (FO), transport to The United Kingdom (UK), transport to mainland Europe (EU) and transport to Oslo in Norway (NO). The transport to disposal (C2) was also different between scenarios.

Alternative transport scenarios

Parameter	Unit	A4					C2				
		IS	FO	UK	EU	NO	IS	FO	UK	EU	NO
GWP	kg CO_2-eqv	1,2E-01	1,6E-01	3,5E-01	3,8E-01	4,6E-01	8,2E-03	8,2E-04	4,1E-02	4,1E-02	4,1E-02
ODP	kg CFC11-eqv	2,9E-17	2,6E-17	5,3E-17	5,8E-17	6,6E-17	2,0E-18	2,0E-19	1,0E-17	1,0E-17	1,0E-17
POCP	kg C_2H_4-eqv	-1,9E-04	1,1E-04	2,9E-04	3,4E-04	4,8E-04	-1,3E-05	-1,3E-06	-6,5E-05	-6,5E-05	-6,5E-05
AP	kg SO_2-eqv	5,0E-04	3,8E-03	8,4E-03	9,5E-03	1,2E-02	3,5E-05	3,5E-06	1,8E-04	1,8E-04	1,8E-04
EP	kg PO_4^{3-}-eqv	1,3E-04	4,3E-04	9,5E-04	1,1E-03	1,3E-03	8,9E-06	8,9E-07	4,5E-05	4,5E-05	4,5E-05
ADPM	kg Sb-eqv	1,0E-08	7,2E-09	1,4E-08	1,5E-08	1,7E-08	7,2E-10	7,2E-11	3,6E-09	3,6E-09	3,6E-09
ADPE	MJ	1,6E+00	2,1E+00	4,4E+00	4,8E+00	5,7E+00	1,1E-01	1,1E-02	5,5E-01	5,5E-01	5,5E-01

Additional Norwegian requirements

Greenhous gas emission from the use of electricity in the manufacturing phase
National production mix electricity (consumption mix, low woltage, including own consumption of power plants, transmission/distribution losse) was used for the electricity used in the manufacturing prosess (A3). Import and export of electricity is nonexistent in Iceland. The Icelandic national production mix is 71% hydropower and 29% geothermal power according dataset below.

Data source	Amount	Unit
GaBi Professional - IS: Electricity grid mix	20,7	g CO_2-eqv/kWh

Dangerous substances

- ☑ The product contains no substances given by the REACH Candidate list or the Norwegian priority list
- ☐ The product contains substances given by the REACH Candidate list or the Norwegian priority list that are less than 0,1 % by weight.
- ☐ The product contain dangerous substances, more then 0,1% by weight, given by the REACH Candidate List or the Norwegian Priority list, see table.
- ☐ The product contains no substances given by the REACH Candidate list or the Norwegian priority list. The product is classified as hazardous waste (Avfallsforskiften, Annex III), see table.

Name	CAS no.	Amount

Indoor environment
No tests have been carried out on the product concerning indoor climate.

Carbon footprint
The Global Warming Potential (GWP) on page 5 provides information about the carbon footprint of the product, i.e. the product stage carbon footprint (A1-A3) is 1,13 kg CO_2-eq. per m² of medium density stone wool and the life cycle carbon footprint (phases A-C) for the EU scenario is 1,65 kg CO_2-eq. per m².

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