epd-norway
Global Program Operator

Environmental Product Declaration

In accordance with ISO 14020, ISO 14025 and EN15804 +A2

Sodium lignin biopolymer D liquid

Owner of the declaration:
Borregaard USA, Inc.

Product name:
Sodium lignin biopolymer D liquid

Functional unit:
1 kg dry matter

Product category /PCR:
PCR Basic Chemicals 2021:03 v.1.1.1

Program holder and publisher:
The Norwegian EPD foundation

Declaration number:
NEPD-5613-4920-EN

Registration number:
NEPD-5613-4920-EN

Issue date: 22.12.2023

Valid to: 22.12.2028

Borregaard

The Norwegian
EPD Foundation

General information

Product:
Sodium lignin biopolymer D liquid

Program Operator:
The Norwegian EPD Foundation (EPD-Norway)
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Declaration Number:
NEPD-5613-4920-EN

This declaration is based on Product Category Rules:
Basic Chemicals 2021:03 v.1.1.1

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:
1 kg dry matter of lignosulfonate, plus its packaging, ready for delivery.

Declared unit with option:
1 kg dry matter of lignosulfonate, plus its packaging, transported to the customer.

Functional unit:
-

Verification:
Independent verification of the declaration and data, according to ISO 14025:2010

internal ☐ External X

Mie Vold, LCA.no AS
Independent verifier approved by EPD Norway

Owner of the declaration:
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Manufacturer:
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Place of production:
Rothschild, Wisconsin, USA

Management system:
ISO 9001:2015

Organization no:
895 623 032

Issue date:
22.12.2023

Valid to:
22.12.2028

Year of study:
2023

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

The EPD has been worked out by:
Mafalda Silva and Ingunn Saur Modahl

Approved

Manager of EPD Norway

Product

Product description:

Borregaard's Sodium lignin biopolymer D liquid is typically used as dispersing agent or binding agent for industrial applications. It is based on spruce softwood, which is a natural and renewable material. The product is safe to handle and store, thus, no classification is required with respect to categories of danger, symbol letters or risk phrases.

Product specification:

Sodium lignin biopolymer D liquid has a dry matter content of 42% when sold to customers. The product consists of lignosulfonate and water.

Materials	kg	%
Product		
Lignosulfonate	0.42	42
Water	0.58	58
Total	**1**	**100**
Packaging		
Polyethylene	0.002	0.20
Steel	0.001	0.14

Technical data:

Dry matter (DM) content: 42%
CAS number: 8061-51-6

Market:

Global

Reference service life, product:

Not relevant

LCA: Calculation rules

Functional unit:

1 kg DM plus its packaging transported over 2 372 km to the customer by typical means of transportation. Transport to customer has been corrected in order to account for the burden of also transporting water.

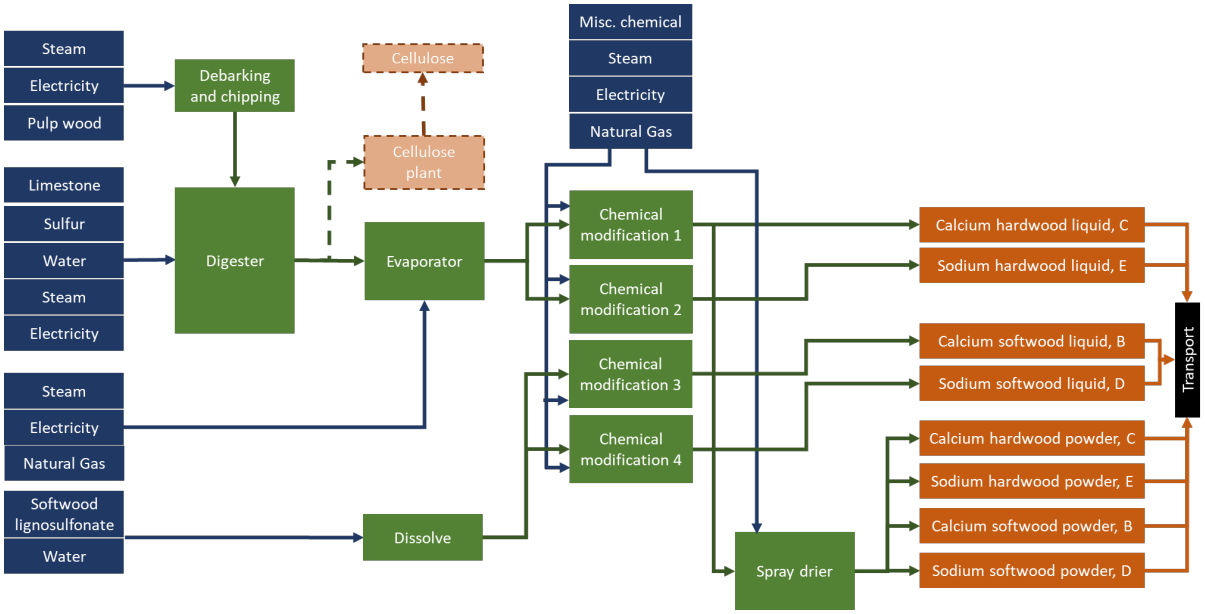
Data quality:

The production data was collected in 2023 and represents an average for 2022. Other data are from Ecoinvent v3.9, released in 2022, but with some changes to improve representativeness. The LCA software used is SimaPro version 9.5.

Allocation:

The allocation is made in accordance with the provisions of ISO 14025 and PCR for Basic Chemicals 2021:03 v.1.1 (Environdec, 2023). Allocation has been, as far as possible, avoided by modelling the processes at Borregaard on a detailed level. When allocation has been necessary, allocation based on mass (DM) has been used.

Flowchart:



The blue boxes indicate input of material and energy, including production and transport (A1-A2). The green boxes illustrate processes taking place at the Borregaard's and the neighboring Domtar's plants in Rothschild, Wisconsin (A3), producing the products (orange boxes). The black box illustrates transport to the customer. Cellulose is included in the flowchart to show that the digester is a multi-output process, where burdens are allocated between the cellulose and sulfite liquor, which is transformed to lignosulfonate products. To preserve readability the direct emissions are not illustrated.

System boundary:

This EPD represents a cradle-to-gate with options analysis. The analysis includes modules A1-A3, comprising extraction, transportation and processing of natural resources, and manufacturing of the product and associated packaging.

Beyond cradle-to-gate, the declared unit with options also includes transport to customers (A4), which comprises transportation of the product plus its packaging over 2 372 km by typical transportation modes; transport of packaging waste (A5) and associated treatment of packaging at its end-of-life (A5); and disposal of packaging and of product through content of biogenic carbon in product (C4). In addition, benefits and loads beyond system boundary for the packaging are also included in the analysis (D).

For the product, modules A5 and B1-B7 are not included due to the wide range of application areas for the chemical products, and difficulties to allocate the environmental burdens related to these processes to the chemical product.

Modules A1-A2 correspond to the upstream processes, A3 core processes, A4 and beyond correspond to downstream processes.

Cut-off criteria:

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

LCA: Scenarios and additional technical information

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

Transport from production place to assembly (A4)

The production takes place in Rothschild, Wisconsin, USA, and transport to customers is included. Transport from production site to customer is based on information from Borregaard regarding typical transport distances and transport modes.

Sodium lignin biopolymer D liquid is transported on a diesel truck, unspecified category, over 1 063 km, and on a diesel freight train over 1 309 km. Transport distance has been corrected in order to account for transport of water. The transport correction factor to account for transport of water for sodium lignin biopolymer D liquid is 2.38. It should be noted that packaging for liquid products is used for road transport only. For rail, as liquid products are transported as bulk, no packaging is required.

Type	Capacity utilisation (incl. return) [%]	Type of vehicle	Distance [km]	Fuel/Energy consumption	Unit
Truck	53	Unspecified, all sizes and European emission classes	1 063	0.099	kg/tkm
Train	50	Freight train	1 309	0.011	kg/tkm

Assembly (A5) & Use (B1-B7)

For the product, modules A5 and B1-B7 are not included due to the wide range of application areas for the chemical products, and difficulties to allocate the environmental burdens related to these processes to the chemical product. However, product packaging waste processing is reported in module A5.

Borregaard does not have any information regarding the end-of-life treatment associated with the packaging of their products, but they assume that most packaging products are sent to recycling at its end-of-life. Therefore, a 100% recycling scenario was considered for the product packaging.

For the transport of the product packaging to a recycling facility at its end-of-life, the following scenario was considered representative as Borregaard's products are sold globally: the product packaging is transported on a diesel truck, unspecified category, over an average transport distance of 500 km.

Type	Capacity utilisation (incl. return) [%]	Type of vehicle	Distance [km]	Fuel/Energy consumption	Unit
Truck	53	Unspecified, all sizes and European emission classes	500	0.099	kg/tkm

End of Life (C2, C3, C4)

Regarding modules C2-C4, the considered PCR allows the exclusion of end-of-life treatment if certain criteria are fulfilled. The considered chemical product fulfills all but one criterion: it contains biogenic carbon. Hence, the carbon content of the product is used to calculate its climate impact at the end of life (C4).

Benefits and loads beyond the system boundaries (D)

The benefits and loads beyond system boundaries are calculated from the net flows shown in the table below. The benefits beyond life cycle are calculated by substituting virgin materials. For the substituted materials, conservative recycled contents have been used, as described in the table below. In addition, the transport from end-of-waste state (after sorting and shredding) to the point of substitution (to the remelting facility assumed to be within a distance of 1 000 km) is included.

Scenario information	Unit	Value
Substitution of electric energy	MJ	0
Substitution of thermal energy	MJ	0
Substitution of raw materials, HDPE (90 % virgin and 10 % recycled)	kg	9.00E-05
Substitution of raw materials, Steel (45 % virgin and 55 % recycled)	kg	3.15E-04
Substitution of fuels	kg	0
Substitution of products	kg	0

Additional technical information

Calculation of the climate change impact in end of life is based on carbon content of product. 1 kg biogenic carbon corresponds to 44/12 kg biogenic CO_2. Carbon content of product is 45.4% of which 3.65% is fossil. Thus, 1.60 kg biogenic CO_2 and 0.0608 kg fossil CO_2 are added in C4 Disposal. As 'oxidation of product' is not an option in this EPD template, 'to landfill' is chosen as scenario in the table under the End of life (C2, C3, C4) heading.

All timber purchased is harvested according to the country-of-origin regulations of harvest, forest management and biological diversity and is PEFC certified (PEFC Chain of custody certificate TP-PEFCCOC-0037).

LCA: Results

As specified in the PCR and EN 15804:2012+A2:2019, the LCA results are presented in the following tables for the environmental impact categories, resource indicators, and waste and outflow indicators. The impacts have been analyzed excluding long-term emissions.

LCA results refer to the production of 1 kg DM product, plus its packaging, transported to the customer.

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, Packaging waste processing	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Product transporting at EoL	Product waste processing at EoL	Product oxidation of carbon content	Reuse-Recovery-Recycling-potential, Packaging
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	X	X

Core environmental impact indicators

Indicator	Unit	A1-A3, Product	A1-A3, Packaging	A4, Product	A4, Packaging
GWP-total	kg CO_2 eq.	5.99E-01	1.43E-02	5.68E-01	5.45E-04
GWP-fossil	kg CO_2 eq.	2.07E+00	1.41E-02	5.65E-01	5.42E-04
GWP-biogenic	kg CO_2 eq.	-1.48E+00	1.39E-04	7.49E-04	8.46E-07
GWP-LULUC	kg CO_2 eq.	5.10E-03	1.26E-05	1.47E-03	1.93E-06
ODP	kg CFC11 eq.	2.03E-07	1.66E-10	9.15E-09	9.65E-12
AP	mol H^+ eq.	2.48E-02	6.10E-05	3.65E-03	2.60E-06
EP-freshwater	kg P eq.	1.73E-04	5.89E-07	6.23E-06	5.40E-09
EP-marine	kg N eq.	2.83E-03	1.20E-05	1.49E-03	9.87E-07
EP-terrestrial	mol N eq.	2.64E-02	1.31E-04	1.61E-02	1.05E-05
POCP	kg NMVOC eq.	9.88E-03	5.33E-05	5.02E-03	3.59E-06
ADP-M&M	kg Sb eq.	1.86E-05	5.75E-08	1.58E-06	1.70E-09
ADP-fossil	MJ	3.17E+01	2.66E-01	7.76E+00	7.77E-03
WDP	m^3	2.63E+00	1.08E-03	4.15E-02	4.24E-05

Indicator	Unit	A5, Packaging	C4, Product	D, Packaging
GWP-total	kg CO_2 eq.	8.14E-04	1.66E+00	-5.36E-04
GWP-fossil	kg CO_2 eq.	8.15E-04	6.08E-02	-5.68E-04
GWP-biogenic	kg CO_2 eq.	-2.47E-06	1.60E+00	3.21E-05
GWP-LULUC	kg CO_2 eq.	1.23E-06	INA	3.10E-07
ODP	kg CFC11 eq.	5.55E-11	INA	-1.05E-11
AP	mol H^+ eq.	3.20E-06	INA	-1.93E-06
EP-freshwater	kg P eq.	2.30E-08	INA	-2.60E-08
EP-marine	kg N eq.	9.39E-07	INA	-2.42E-07
EP-terrestrial	mol N eq.	1.04E-05	INA	-3.11E-06
POCP	kg NMVOC eq.	3.41E-06	INA	-2.34E-06
ADP-M&M	kg Sb eq.	2.39E-09	INA	-3.41E-10
ADP-fossil	MJ	1.04E-02	INA	-9.64E-03
WDP	m^3	1.41E-04	INA	-2.64E-05

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 consumption;* ***INA*** *Information not available*

Additional environmental impact indicators

Indicator	Unit	A1-A3, Product	A1-A3, Packaging	A4, Product	A4, Packaging
PM	Disease incidence	1.92E-07	7.87E-10	5.72E-08	5.36E-11
IRP	kBq U235 eq.	6.86E-02	2.51E-04	3.57E-03	3.03E-06
ETP-fw	CTUe	4.00E+02	1.01E-01	5.35E+00	5.91E-03
HTP-c	CTUh	3.72E-09	3.26E-11	3.53E-10	2.87E-13
HTP-nc	CTUh	1.54E-06	2.91E-10	8.02E-09	8.12E-12
SQP	Dimensionless	1.45E+02	5.18E-02	5.54E+00	6.13E-03

Indicator	Unit	A5, Packaging	C4, Product	D, Packaging
PM	Disease incidence	5.78E-11	INA	-2.95E-11
IRP	kBq U235 eq.	1.99E-05	INA	-2.36E-06
ETP-fw	CTUe	7.13E-03	INA	3.23E-04
HTP-c	CTUh	7.37E-13	INA	-2.72E-12
HTP-nc	CTUh	1.24E-11	INA	-9.25E-12
SQP	Dimensionless	8.16E-03	INA	9.62E-04

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;* ***INA*** *Information not available*

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

Indicator	Unit	A1-A3, Product	A1-A3, Packaging	A4, Product	A4, Packaging
RPEE	MJ	3.21E+01	1.34E-02	1.47E-01	1.22E-04
RPEM	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TPE	MJ	3.21E+01	1.34E-02	1.47E-01	1.22E-04
NRPE	MJ	3.17E+01	1.90E-01	7.76E+00	7.77E-03
NRPM	MJ	0.00E+00	7.60E-02	0.00E+00	0.00E+00
TRPE	MJ	3.17E+01	2.66E-01	7.76E+00	7.77E-03
SM	kg	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
NRSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	m^3	1.07E-01	4.69E-05	1.73E-03	1.88E-06

Indicator	Unit	A5, Packaging	C4, Product	D, Packaging
RPEE	MJ	3.93E-04	INA	-1.42E-04
RPEM	MJ	0.00E+00	INA	0.00E+00
TPE	MJ	3.93E-04	INA	-1.42E-04
NRPE	MJ	1.04E-02	INA	-9.64E-03
NRPM	MJ	0.00E+00	INA	0.00E+00
TRPE	MJ	1.04E-02	INA	-9.64E-03
SM	kg	0.00E+00	INA	0.00E+00
RSF	MJ	0.00E+00	INA	0.00E+00
NRSF	MJ	0.00E+00	INA	0.00E+00
W	m^3	4.17E-06	INA	-6.35E-07

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;* ***INA*** *Information not available*

End of life – Waste

Indicator	Unit	A1-A3, Product	A1-A3, Packaging	A4, Product	A4, Packaging
HW	kg	1.56E-04	6.21E-07	4.92E-05	4.95E-08
NHW	kg	1.33E+00	1.06E-02	4.85E-01	5.97E-04
RW	kg	4.37E-05	1.54E-07	2.14E-06	1.78E-09

Indicator	Unit	A5, Packaging	C4, Product	D, Packaging
HW	kg	2.64E-08	INA	-4.89E-08
NHW	kg	6.82E-04	INA	-3.93E-04
RW	kg	2.64E-08	INA	-1.49E-09

HW *Hazardous waste disposed;* ***NHW*** *Non hazardous waste disposed;* ***RW*** *Radioactive waste disposed;* ***INA*** *Information not available*

End of life – output flow

Indicator	Unit	A1-A3, Product	A1-A3, Packaging	A4, Product	A4, Packaging
CR	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MR	kg	3.35E-05	0.00E+00	0.00E+00	0.00E+00
MER	kg	6.00E-03	0.00E+00	0.00E+00	0.00E+00
EEE	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ETE	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Indicator	Unit	A5, Packaging	C4, Product	D, Packaging
CR	kg	0.00E+00	INA	0.00E+00
MR	kg	2.79E-03	INA	0.00E+00
MER	kg	1.01E-04	INA	0.00E+00
EEE	MJ	2.30E-04	INA	0.00E+00
ETE	MJ	4.50E-04	INA	0.00E+00

CR *Components for reuse;* ***MR*** *Materials for recycling;* ***MER*** *Materials for energy recovery;* ***EEE*** *Exported electric energy;* ***ETE*** *Exported thermal energy;* ***INA*** *Information not available*

Reading example: 9.0E-03 = $9.0*10^{-3}$ = 0.009

Information describing the biogenic carbon content at the factory gate

Biogenic carbon content	Unit	Value
Biogenic carbon content in product	kg C	4.37E-01
Biogenic carbon content in the accompanying packaging	kg C	0.00E+00

Note: 1 kg biogenic carbon is equivalent to 44/12 (approx. 3.67) kg CO_2

The biogenic carbon content in the product is linked to the lignin feedstock, an organic polymer. As the packaging is made of plastic and steel, the biogenic carbon content in the packaging is zero.

Additional 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) used for modelling the production process (A3) is from ecoinvent v3.9, which was released in 2022. The manufacturing takes place in Rothschild, Wisconsin, USA.

National electricity grid	Data source	GWP-total [kg CO_2 eq/kWh]
Electricity, medium voltage {MRO, US only}| market for electricity, medium voltage | Cut-off, U	ecoinvent V3.9	0.521

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 referred to as GWP-GHG in context to Swedish public procurement legislation.

Indicator	Unit	A1-A3, Product	A1-A3, Packaging	A4, Product	A4, Packaging
GWP-IOBC	kg CO_2 eq.	2.20E+00	1.43E-02	5.68E-01	5.45E-04

Indicator	Unit	A5, Packaging	C4, Product	D, Packaging
GWP-IOBC	kg CO_2 eq.	8.14E-04	5.94E-02	-5.36E-04

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.
- ☐ 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 contains dangerous substances, more than 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 (Avfallsforskriften, Annex III), see table.

Indoor environment

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

Bibliography

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EN 15804:2012+A2:2019	Sustainability of construction works - Environmental product declaration - Core rules for the product category of construction products.
ISO 9001:2015	Quality management systems — Requirements.
ISO 14020:2022	Environmental statements and programmes for products - Principles and general requirements. Geneva, Switzerland, International Organization for Standardization.
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.
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ECO PLATFORM EPD VERIFIED	ECO Platform ECO Portal	Website: Website:	www.eco-platform.org ECO Portal