epd-norway
Global Program Operator

Environmental Product Declaration

In accordance with ISO 14025

Exilva F 01-V

Borregaard

Owner of the declaration:
Borregaard AS

Product name:
Exilva F 01-V

Declared unit:
1 kg dry matter

Product category/PCR:
Basic Chemicals 2021:03 v.1.1

Program holder and publisher:
The Norwegian EPD foundation

Declaration number:
NEPD-4085-3060-EN

Registration Number:
NEPD-4085-3060-EN

Issue date: 30.12.2022

Valid to: 30.12.2027

The Norwegian
EPD Foundation

General information

Product:
Exilva F 01-V

Program Holder:
The Norwegian EPD Foundation
Post Box 5250 Majorstuen, 0303 Oslo, Norway
Phone: +47 23 08 80 00
Email: post@epd-norge.no

Declaration Number:
NEPD-4085-3060-EN

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

Declared unit with option:
1 kg dry matter, excluding packaging, transported to customer.

Functional unit:

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

internal ☐ External X

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

Owner of the declaration:
Borregaard AS
Contact person: Hilde Fredheim
Phone: +47 917 94 121
Email: hilde.fredheim@borregaard.com

Manufacturer:
Borregaard AS
PO Box 162, 1701 Sarpsborg, Norway
Phone: +47 69 11 80 00
e-mail: borregaard@borregaard.com

Place of production:
Sarpsborg, Norway

Management system:
ISO 9001 (Quality Management), ISO 14001 (Environmental Management) and ISO 50001 (Energy Management)

Organisation no:
895623032

Issue date:
30.12.2022

Valid to:
30.12.2027

Year of study:
2022

Comparability:
EPDs from other programs than the Norwegian EPD-Foundation may not be comparable.

The EPD has been worked out by:
Ellen Soldal

Approved

Manager of EPD Norway

Product

Product description:

Borregaard's Exilva is cellulose fibrils made from renewable and sustainable wood raw material. Exilva has multifunctional properties and is used in industrial applications to improve viscosity and stability, flow and sag/drip control, spray ability of thick formulations, strength and flexibility (anti-cracking) of coatings/cured formulation/glue joints, film forming and barrier performance, emulsion and particle suspension stability. Exilva is non-toxic and safe to handle and store, thus, no classification is required with respect to categories of danger, symbol letters or risk phrases.

Typical dosage level of Exilva is low, <0.5% w/w relative to the overall weight of the formulation.

Product specification:

Exilva F 01-V is a paste containing 10% cellulose fibrils and 90% water when sold to customers.

Materials*	kg	%
Cellulose (CAS 9004-34-6)	0.10	10
Water	0.90	90
Total	1	100

*Here the product content is given on a wet basis as sold to customers. However, the data and the results in this EPD are given per kg dry matter (DM).

Technical data:

Dry matter (DM) content: 10%

Market:

Global

Reference service life:

Not relevant

LCA: Calculation rules

Declared unit:

1 kg DM, without packaging, including 1 000 km road transport to customer.

Cut-off criteria:

All major raw materials and all the essential energy is included. The production processes for raw materials and energy flows with very small amounts (less than 1%) are not included. These cut-off criteria do not apply for hazardous materials and substances.

Packaging contributes to less than 1% to the climate change indicator and is excluded.

Allocation:

The allocation is made in accordance with the provisions of ISO 14025 and Basic Chemicals 2021:03 v.1.1 (Environdec, 2021). Allocation has as far as possible, been avoided by modelling the processes at Borregaard on a detailed level. When allocation has been necessary, allocation based on mass (DM) has been used. In processes with hot water as an outflow and where the hot water is exploited in other processes, the energy content has been calculated into mass through use of the heat value for biological dry matter.

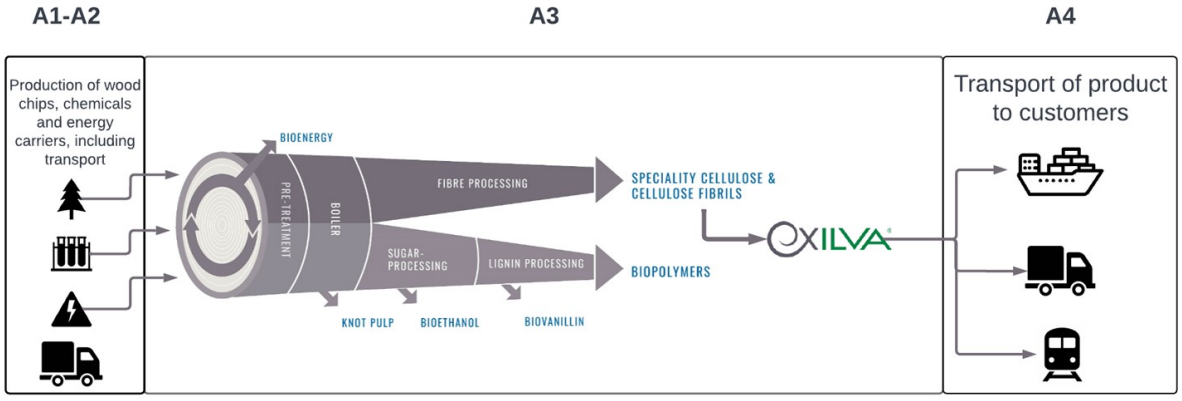
Data quality:

Data on consumption of natural resources, energy carriers and chemicals, and transport modes are site specific from Borregaard Sarpsborg in Norway. Foreground data refer to the year 2021. For background processes, ecoinvent, *Allocation, cut-off by classification* version 3.8 (Wernet et al., 2016) have been used.

The energy mix used in steam production is averaged over seven years (2014-2020). This was done because the input of electricity and natural gas fluctuates between years depending on price. To get a representative annual value for energy in steam production, the input of electricity and natural gas was averaged over the 7-year period. In this period, the average share of electricity input in the steam boiler was 63%, while the average share of natural gas was 37%.

System boundary:

The system boundary includes the modules A1-A4, illustrated by the flowchart. A1-A4 includes extraction, transportation and processing of natural resources, manufacturing of the product and transportation of the product. Specific transport modes and distances are not available, hence, in accordance with PCR Basic Chemicals 2021:03 v.1.1 (Environdec, 2021) 1 000 km road transport is included. The modules A1-A2 corresponds to the upstream module, A3 to the core module, while A4 and beyond corresponds to downstream module.



LCA: Scenarios and additional technical information

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

The production takes place in Sarpsborg, Norway, and transport to customers is included, according to PCR. Exilva F 01-V paste is assumed transported 1 000 km on road. The transport burdens are corrected for transport of water content in product.

No scenario after A4 is included. The biogenic content of the product at factory gate has been used to calculate the emissions of CO_2 from end-of-life.

Transport from production place to assembly/user (A4)

Type	Capacity utilisation (incl. return) %	Type of vehicle	Distance km	Fuel/Energy consumption	value (kg fuel/kg)
Truck	55%	Transport, freight, lorry 16-32 metric ton, euro6 {RER}| market for transport, freight, lorry 16-32 metric ton, EURO6 | Cut-off, S	1 000	3.7e-5 kg/kgkm	0.037

A transport correction factor has been used in order to account for transport of the water contained in the product (90% water). The transport correction factor for Exilva F 01-V is 10.

Additional technical information

The impacts are given per kg DM. The DM content of the product is 10%. Hence, in order to get the environmental impact per kg wet weight, the results in A1-A3 and C4 should be multiplied with the DM concentration, which is 0.1.

Calculation of the climate change impact in end of life is based on carbon content of product. Carbon content of the product is 0.4 kg carbon/kg DM. 1 kg biogenic carbon corresponds to 44/12 kg biogenic CO_2. Thus, 1.47 kg CO_2 is added in C4 Disposal.

Exilva F 01-V is a novel product, and the market is immature, thus, a generic transport distance is used in A4. Climate change emissions factors per kgkm are provided, so that a purchaser can calculate the climate change total impact for other transport distances and means of transport. The emissions factors are given both per kg DM and per kg wet weight.

Type	Type of vehicle	Climate change total (kg CO_2-eq/kgkm) 1 kg wet weight	Climate change total (kg CO_2-eq/kgkm) 1 kg dry matter
Truck	Transport, freight, lorry 16-32 metric ton, euro6 {RER}| market for transport, freight, lorry 16-32 metric ton, EURO6 | Cut-off, S	1,63E-04	1,63E-03
Boat	Transport, freight, sea, container ship {GLO}| market for transport, freight, sea, container ship | Cut-off, S	9,42E-06	9,42E-05
Rail	Transport, freight train {RER}| market group for transport, freight train | Cut-off, U	4,52E-05	4,52E-04

Borregaard uses Norway spruce harvested in Norway (approx. 78%), Sweden (approx. 20%) and Germany (approx. 2%). All timber purchased is harvested according to the country-of-

origin regulations of harvest, forest management and biological diversity (PEFC Chain of custody certificate SA-PEFC/COC-006557, FSC Chain of custody certificate SA-COC-006557). All timber harvested in Norway is certified according to the PEFC standard.

LCA: Results

For A1-A3, the environmental impact indicator Climate change – total is dominated by the uptake of biogenic CO_2 in A1 that is included as carbon in the product. The carbon that is contained in the product is emitted as CO_2 when the product is incinerated/decomposed. This impact is included in C4. For the climate change – fossil, the main contribution in A1-A3 is energy, both in the form of electricity and steam.

System boundaries (X=included, MID=module not declared, MIR=module not relevant)

Product stage			Assembly stage		Use stage							End of life stage				After EOL
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	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	X	MNR

Core environmental impact indicators

Indicator	Unit	A1-A3	A4	C4
GWP-total	kg CO2 eq.	-7,02E-01	1,63E+00	1,47E+00
GWP-fossil	kg CO2 eq.	1,22E+00	1,63E+00	0,00E+00
GWP-biogenic	kg CO2 eq.	-1,93E+00	1,48E-03	1,47E+00
GWP-LULUC	kg CO2 eq.	8,03E-03	6,51E-04	INA
ODP	kg CFC11 eq.	1,73E-07	3,77E-07	INA
AP	mol H^+ eq.	9,95E-03	4,62E-03	INA
EP-freshwater	kg P eq.	7,42E-05	1,16E-05	INA
EP-marine	kg N eq.	1,46E-03	9,19E-04	INA
EP-terrestrial	mol N eq.	1,30E-02	1,02E-02	INA
POCP	kg NMVOC eq.	3,86E-03	3,94E-03	INA
ADP-M&M	kg Sb eq.	7,95E-05	5,77E-06	INA
ADP-fossil	MJ	1,99E+01	2,47E+01	INA
WDP	m^3	1,04E+00	7,52E-02	INA

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;* ***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*

Additional environmental impact indicators

Indicator	Unit	A1-A3	A4	C4
PM	Disease incidence	7,79E-08	1,31E-07	INA
IRP	kBq U235 eq.	2,56E-01	1,07E-01	INA
ETP-fw	CTUe	3,31E+02	1,94E+01	INA
HTP-c	CTUh	4,68E-09	6,23E-10	INA
HTP-nc	CTUh	6,49E-07	1,96E-08	INA
SQP	Dimensionless	1,65E+02	1,72E+01	INA

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 are 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	C4
RPEE	MJ	1,16E+02	3,54E-01	INA
RPEM	MJ	1,91E+01	0,00E+00	INA
TPE	MJ	1,35E+02	3,54E-01	INA
NRPE	MJ	1,99E+01	2,47E+01	INA
NRPM	MJ	0,00E+00	0,00E+00	INA
TRPE	MJ	1,99E+01	2,47E+01	INA
SM	kg	0,00E+00	0,00E+00	INA
RSF	MJ	0,00E+00	0,00E+00	INA
NRSF	MJ	0,00E+00	0,00E+00	INA
W	m^3	7,99E-01	2,79E-03	INA

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	C4
HW	KG	7,51E-05	6,45E-05	INA
NHW	KG	1,96E+00	1,45E+00	INA
RW	KG	1,37E-04	1,67E-04	INA

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

End of life – output flow

Parameter	Unit	A1-A3	A4	C4
CR	kg	0,00E+00	0,00E+00	INA
MR	kg	3,88E-05	0,00E+00	INA
MER	kg	6,96E-03	0,00E+00	INA
EEE	MJ	0,00E+00	0,00E+00	INA
ETE	MJ	0,00E+00	0,00E+00	INA

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

Information describing the biogenic carbon content at the factory gate

Biogenic carbon content	Unit	Value
Biogenic carbon content in product	kg C	0.4
Biogenic carbon content in the accompanying packaging	kg C	NA

1 kg biogenic carbon corresponds to 44/12 kg biogenic CO_2.

Additional Norwegian requirements

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

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

Electricity mix	Data source	Value	Unit
Low voltage, NO	ecoinvent 3.8	26.8	g CO2-eq/kWh

Dangerous substances

X The product contains no substances given by the REACH Candidate list or the Norwegian priority list

o The product contains substances given by the REACH Candidate list or the Norwegian priority list that are less than 0,1 % by weight.
o The product contains dangerous substances, more then 0,1% by weight, given by the REACH Candidate List or the Norwegian Priority list, see table.
o 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.

Indoor environment

The product meets the requirements for low emissions.

Bibliography

Environdec: 2021	PCR 2021:03. Version 1.1 Basic chemicals. Product category classification: UN CPC 341, 342, 343, 345 (except subclass 3451). , Environdec. PCR 2021:03.
FCS: 2019	FCS Chain of Custody certificate. Certificate No SA-COC-006557.
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
PEFC: 2018	PEFC Chain of custody certificate PEFC ST:2002:2013 Chain of custody of Forest Based Products. Certificate no. SA-PEFC/COC-006557.
Soldal and Modahl: 2022	EPD: LCA report for verification - Exilva from Borregaard. OR.38.22. NORSUS.
Wernet, G. et al.: 2016	"The ecoinvent database version 3 (part I): overview and methodology." The International Journal of Life Cycle Assessment 21(9): 1218-1230.

epd-norway Global Program Operator	**Program Operator**	Phone	+47 23 08 80 00
	The Norwegian EPD Foundation		
	Post Box 5250 Majorstuen, 0303 Oslo	Email	post@epd-norge.no
	Norway	Web	www.epd-norge.no
epd-norway Global Program Operator	**Publisher**	Phone	+47 23 08 80 00
	The Norwegian EPD Foundation		
	Post Box 5250 Majorstuen, 0303 Oslo	Email	post@epd-norge.no
	Norway	Web	www.epd-norge.no
Borregaard	**Owner of the declaration**	Phone	+47 69 11 80 00
	Borregaard AS	Fax	+47 69 11 87 70
	Hjalmar Wessels vei 10, 1701 Sarpsborg	Email	borregaard@borregaard.no
	Norway	Web	www.borregaard.no
NORSUS Norsk institutt for bærekraftsforskning	**Author of the life cycle assessment**	Phone	+47 69 35 11 00
	NORSUS AS		
	Stadion 4, 1671 Kråkerøy	Email	post@norsus.no
	Norway	web	www.norsus.no
ECO PLATFORM EPD VERIFIED	ECO Platform	web	www.eco-platform.org
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