Report for review

According ISO 14025 and EN 15804

Owner of the Declaration	**Forbo Eurocol Nederland B.V.**
Publisher	NIBE Research bv
Calculation number	EPD-NIBE-20190128-3817
Issue date	
Valid until	

LiquidDesign per mm

Forbo Eurocol Nederland B.V.

www.epdnibe.com

eurocol

NIBE EXPERTS IN SUSTAINABILITY

1. VERIFICATION OF THE LIFE CYCLE ASSESSMENT

CEN standard EN 15804:2012 serves as the core PCR
Independent verification of the declaration. according to EN ISO 14025:2010. ☐ Internal ☐ External

1.1 STATEMENT EXTERNAL REVIEWER NIBE'S EPD APPLICATION

IVAM performed the review of the NIBE 'EPD online' calculation tool.
The documents concerned are:

- 25011.16.03.015 - Protocol EPD online - NMD v1.2.docx
- 25.011.150923 - Calculation Rules LCA application NIBE v2.4.docx
- 25.011.150923 - Validation calculation rules v2.7.xlsx
- 25011.16.03.014 - SBK Verification Protocol version 2.0 TIC version – NIBE EPD tool online version 1.1.docx
- 25.011.161124 - Procedure review applicatie en berekeningen.docx

The tool itself is tested by checking the environmental profiles that serve as basis and three validation checks that cover all relevant functionality of the tool.

The conclusion of the review is that the tool meets the requirements of the Dutch Assessment Method Environmental Performance Construction and Civil Engineering Works(GWW) 2014. Using the tool for EPD-calculations will only need a 'light' additional review since the core (the tool itself) is reviewed already.

Harry van Ewijk, IVAM UvA BV, 30 november 2016

1.2 STATEMENT EXTERNAL REVIEWER EPD PRODUCT CALCULATION

2. GENERAL

2.1 INTRODUCTION

This report for review is a result of a life cycle analysis (LCA) made by using NIBE's EPD application. The report is based on the following chapters which correspond to the phases of a LCA.

- Goal and scope definition
- Life cycle inventory
- Impact assessment
- Interpretation

The application of NIBE is third party verified. As a result, many of the criteria that needs to be reviewed for an LCA according to EN15804 have already been verified. The operation and prescribed use of NIBE's EPD application are stated in the protocol which can be download at www.epdnibe.com

2.2 COMPANY INFORMATION / DECLARATION OWNER

Manufacturer:	Forbo Eurocol Nederland B.V.
Production Location:	Forbo Eurocol
Address:	Industrieweg 1-2 1521 NA Wormerveer
E-mail:	rob.eijgelsheim@forbo.com
Website:	www.forbo.com

2.3 EPD INFORMATION

EPD for:	LiquidDesign per mm
Calculation number:	EPD-NIBE-20190128-3817
Date of issue:	
End of validity:	
Version NIBE's EPD Application:	1.0
Version Environmental Profile database:	v2.76 (2019-01-08)
PCR:	SBK bepalingsmethode v2.0 incl. Wijzingingsblad overgang naar EcoInvent v3.3 of 1th June 2017

2.4 CALCULATION BASIS

LCA Method	INSIDE/INSIDE
LCA Software	Simapro 8.5.2
characterization method	CML ?IA (Baseline) version 4.1, dated October 2012
LCA database profiles	EcoInvent version 3.3
Used protocol	25.011.151214 - Protocol NIBE's EPD application, December 2015
Version database	v2.76 (2019-01-08)

2.5 PROJECT TEAM

The project team for the drafting this LCA consists the following persons:

Rob Eijgelsheim [Forbo Eurocol]
Gert-Jan van Beijnum [NIBE]
Agatha van Gent [NIBE]

2.6 USED ABBREVIATIONS

EPD	Environmental Product Declaration
SBK	Stichting Bouwkwaliteit
NMD	Nationale Milieu Database (Dutch National Environmental Profile Database)
Sp	Shadow price / Environmental Cost Indicator
RSL	Reference service life
LCA	Life Cycle Assesment

3. GOAL AND SCOPE DEFINITION

3.1 PURPOSE AND TARGET GROUPS

The purpose of this LCA is to compile environmental data of materials and products used in a non-domestic interior. So that the environmental data can be used in calculations of interieurs or the LCA of a final product. The purpose of this report is to draw up a review dossier for the product based on the INSIDE/INSIDE horizontal PCR v1.0 2018-10-05. This document defines a standardized method for a LCA in Europe, of a product used in a non-domestic interior, in accordance with the EN 15084:2012+A1.

The target groups of this LCA study are users of the INSIDE/INSIDE platform. With this platform the environmental impact of an entire interior be calculated and possibly certified (e.g. Breeam-NL refurbishment and fit-out).

3.2 DECLARED UNIT

m2

Unit: No functional unit specified

One square meter of LiquidDesign with a thickness of 1mm. Included are production (A1-A3) of the product, assemble in the project (A4 and A5), necessary maintenance (B2) and repairs (B3). Also including the end-of-life scenario (C1-C4) and Module D. The modules B1, B3, B5, B6 and B7 are not applicable and are set equal to 0. As prescribed in the Horizontal PCR of Inside/Inside module A4 is declared for 1 km and modules B2 and B3 are declared for 1 year.

Calculation is made in accordance with the Horizontal PCR of Inside version 1.2 and the Product PCR Floorcovering version 1.0.

3.3 ENVIRONMENTAL PROFILE AND RATINGS REPRESENTIVE

The input data are representative for LiquidDesign per mm, a product of Forbo Eurocol Nederland B.V.. The data are representative for Netherlands.

3.4 SCOPE OF DECLARATION

This is a cradle to grave EPD. The life cycle stages included are as shown below:
(X = included, MND = module not declared)

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	MND	MND	MND	MND	X	X	X	X	X

3.5 CUT-OFF CRITERIA

In the Life cycle assessment the following is included in this study:

Product stage (A1-A3)
The production phase consists of the extraction of raw materials, transportation of the raw materials, processing the raw materials into materials and the production of the product. The required energy for production, external treatments, ancillary materials, packaging material and production emissions are included.

Construction process stage (A4-A5)
This stage consists of the transport of the product from production gate to the construction site. It also includes wastage of construction products (additional production processes to compensate for the loss of wastage of products) and waste processing of the waste from product packaging and product wastage during the construction processes up to the end-of-waste state or disposal of final residues. The installation of the product into the building including manufacture and transportation of ancillary materials and any energy or water required for installation or operation of the construction site are taken into account. It also includes on-site operations to the product.

Use stage (B1-B3)
This stage consists of the impacts arising from components of the building and construction works during their use.
The stage also covers the combination of all planned technical and associated administrative maintenance actions during the service life to maintain the product installed in a building, in a construction works or its parts in a state in which it can perform its required functional and technical performance, as well as preserve the aesthetic qualities of the product. This will include preventative and regular maintenance activities.

End of life stage (C1-C4)
When the end of the life of the building is reached, the de-construction/demolition begins. The de-construction/demolition is not included in the system boundaries, because they go beyond the responsibility of the producer. This EPD does include the necessary transport (C2) from the demolition site to the sorting location and final disposal. In addition, the prescribed waste scenarios from the SBK Bepalingsmethode v2.0 have been used for the various materials in the product. The end of life stage includes the disposal to

landfill and incineration. Recycling, re-use and exported energy are part of 'supplementary information' beyond the building life cycle.

The Combustion emissions and emissions from waste treatment for recovery and / or recycling are included in C4 instead of declaring separately at the module C3.

Supplementary information outside the building life cycle (D)
This stage contains the environmental costs and benefits of recycling and re-use of material released during demolition, and the environmental benefits of recycled or re-used materials used as raw material in the product. In addition, the environmental benefits of saving energy due to incineration where energy is generated, are granted at this stage. The amount of avoid energy is based on the Lower Heating Values of the materials and the efficiencies of the incinerators as mentioned in the SBK Bepalingsmethode v2.0

3.6 ALLOCATION

N.A.

4. PRODUCT

4.1 PRODUCT DESCRIPTION

LiquidDesign is a cast linoleum based on natural raw materials. The product is made up of resins, linseed oil, wood- and cork flour, limestone, cork and natural pigments, which are applied seamlessly in the work.

Range of application:

- Class 23 domestic heavy (minimum thickness 2 mm)
- Class 34 commercial very heavy (minimum thickness 2 mm)
- Class 43 industrial heavy (minimum thickness 2.5 mm)

Characteristics:

- Mass per Functional Unit: 0.9kg per m2 of 1 mm thickness
- Volumetric mass density: 0.9 kg/dm3
- Layer thickness: 2 - 6 mm

Technical data:

- Electrical behaviour: EN 1815. <2 kV
- Thermal conductivity: EN ISO 12524. 0.15 W/m.k. Suitable for underfloor heating
- CE number: EN 13813:2002
- LiquidDesign: contains recycled content
- Reaction to fire: EN 13501-1. Bfl-S1. Class 1 when tested in accordance with ASTM E-648 Critical Radiant Flux. Meets 450 or less, when tested in accordance with ASTM 662/ NFPA 258 Smoke Density.
- Slip resistance: DIN 51130. R9 standard/ R11 upon request EN. 13893. DS: ≥ 0.30. Meets or exceeds the industry recommendation of >0.5 for flat surfaces when tested in accordance with ASTM D-2047.

Maintenance:

Dry cleaning with a vacuum cleaner or a dustmob twice a week. Wet cleaning with a singledisc machine once a month using an adequate maintenance pad without detergent or neutral cleaner.

4.2 DESCRIPTION PRODUCTION PROCESS

At quartzline the ingredients are mixed in a tub for 5 consecutive hours, containing 3500 kg of material, for which the energy consumption is 45kWh (power is 9kW). The tub is tapped empty, in case some of the product stays behind it will be mixed into the next batch. After the mixing the material is packed in buckets of 20 l.

4.3 DESCRIPTION CONSTRUCTION PROCESS

The product is applied by hand with a flat trowel in the work. The product can be applied with a ambient temperature of minimal 15 degrees and a substrate temperature of minimal 12 degrees Celcius.

The LiquidDesign is walkable after 24 hours of hardening. Full chemical hardening has taken place after 7 days at an average temperature of 15 ° C.

4.4 REFERENCE SERVICE LIFE

RSL of the product

Product	RSL [yr]
LiquidDesign per mm	10

RSL of the product parts / Raw materials

Description	Material	RSL [yr]
Raw Materials		
1 mm¹ LiquidDesign (1mm thick, per m2)		
Calcium carbonate	Limestone, milled, loose (NL)	10
Cork flour	Cork powder	10
Ferric oxide	Magnetite (iron(II,III) oxide)	10
Linseed oil	Linseed/rape oil	10
Vegetable oil	Soya oil	10
Additional Raw Materials		
External treatments		

Description	Material	RSL [yr]
N.A.		
Maintenance		
Cleaning solution	Chemicals inorganic	1
Energieverbruik	Electricity (NL) - low voltage (230-400 V)	1
water	Water - Tap water	1

Substantiation RSL Product
The horizontal PCR of floor covers, declared for Inside/inside, is used to determine the product lifetime for LiquidDesign. ***Substantiation RSL Product parts / Raw Matterials***
N.A.

All materials are inseparable after mixing.

4.5 SCALING

Parameter	Value
Scaling type	Linear
Description dimension	thickness
Dimension	1.000
Scalable dimension	1.000
Unit dimension	mm

5. LIFE CYCLE INVENTORY

5.1 RAW MATERIALS SUPPLY (A1)

Description	Material	Amount [kg]	Amount of production waste [kg]	Comments
1 mm¹ LiquidDesign (1mm thick, per m2)				
Calcium carbonate	Limestone, milled, loose (NL)	0.090	0.004	
Cork flour	Cork powder	0.180	0.009	
Ferric oxide	Magnetite (iron(II,III) oxide)	0.018	0.001	
Linseed oil	Linseed/rape oil	0.090	0.004	
Vegetable oil	Soya oil	0.540	0.027	
Raw Materials				
		0.918 kg	**0.046 kg**	

5.2 TRANSPORT TO MANUFACTURER (A2)

Transport distances suppliers to destination

Supplier	Transport Conveyance 1	Distance 1 [km]	Transport Conveyance 2	Distance 2 [km]	Transport Conveyance 3	Distance 3 [km]
Sibelco	Lorry (Truck), unspecified (default)	177				
JPS Cork	Lorry (Truck), unspecified (default)	2116				
Bayer	Lorry (Truck), unspecified (default)	267				
Huntsman Holland	Lorry (Truck), unspecified (default)	105				
Quartzline	Lorry (Truck), unspecified (default)	118				

Transport movements

Transport Movement	Transport Conveyance	Weight x distance [TKM]
Transport from suppliers and indirect suppliers to Forbo Eurocol Nederland B.V.	Multiple Transport Conveyance	0.59
Transport to external treament	Multiple Transport Conveyance	0

5.3 PRODUCTION PROCESS (A3)

Production waste
The generated waste during production is shown by 5.1 Raw Materials Supply. The applicable waste scenarios for the generated production waste are listed at 5.9 to 5.11.

Energy Consumption

Description	Energy	Amount	Unit	Comments
N.A.				

Emissions

Description	Emission(s) to air/soil/water	Amount	Unit	Comments
N.A.				

Packaging Materials

Description	Material	Amount	Unit	Comments
20L emmer (per liter)	Polyethylene teraphtalate (PET), injection moulded	0.032	kg	0.635kg per emmer/20L.

Ancillary Materials

Description	Material	Amount	Unit	Comments
N.A.				

External Treatments

Description	Material	Amount	Unit	Comments
N.A.				

5.4 TRANSPORT TO BUILDING SITE (A4)

Transport movement	Transport conveyance	Distance [km]	Weight x distance [TKM]
Transport to building site	Lorry (Truck), unspecified (default)	1	0

5.5 CONSTRUCTION STAGE (A5)

Material / energy use during the construction stage

Description	Material / Energy	Amount	Unit	Comments
N.A.				

Waste generated during the construction stage
Output materials as result of waste processing at the building site is 5% of LiquidDesign per mm. The waste scenario's as stated in 5.9 to 5.11 are applicable for the processed waste.

Packaging Material	End of life scenario	Amount [kg]	% landfill	% incineration	% recycling	% reuse
20L emmer (per liter)	polyolefines (i.a. pe,pp) (i.a. pipes, foils)	0.032	10	85	5	0

Transport during construction stage

Transport movement	Transport conveyance	Weight x distance [TKM]
Transport to during construction stage	Multiple Transport conveyance	0

5.6 USE STAGE (B1)

LiquidDesign complies with the quality tested in **Indoor Air Comfort GOLD** for:

- Belgian regulation
- French regulation, A class (or A+ class for indoor Air Comfort GOLD)
- German regulation, AgBB
- Draft Lithuanian regulation
- Planned Swedish regulation
- E1 classification
- EMICODE
- GUT
- Several EU ecolabel criteria
- Several Blue Angel criteria
- Several Austrian ecolabel criteria
- LEED outside North America
- FEMB standard for sustainable office furniture
- BREEAM
- M1 only partly

(see Corques-LEED.pdf)

Description	Emission(s) to air/soil/water	service cycle (yr)	number of service cycles	Total amount	Unit
N.A.					

5.7 MAINTENANCE (B2)

Description	Material/Energy	service cycle (yr)	number of service cycles	Total amount	Unit
Cleaning solution	Chemicals inorganic	1	9	0.36	kg
Energieverbruik	Electricity (NL) - low voltage (230-400 V)	1	9	4.95	kWh
water	Water - Tap water	1	9	27	kg

5.8 REPAIR (B3)

Description	Material	Service cycle (yr)	Number of service cycles	Total amount incl. waste [kg]	Total amount of waste [kg]
N.A.					

5.9 TRANSPORT END LIFE STAGE (C2)

Material	End of life scenario	Landfill [km]	Incineration [km]	Recycling [km]	Reuse [km]
1 mm¹ LiquidDesign (1mm thick, per m2)					
Limestone, milled, loose (NL)	organic material (via residue)	100	150	50	0
Cork powder	organic material (via residue)	100	150	50	0
Magnetite (iron(II,III) oxide)	organic material (via residue)	100	150	50	0
Linseed/rape oil	organic material (via residue)	100	150	50	0
Soya oil	organic material (via residue)	100	150	50	0
Raw Materials					

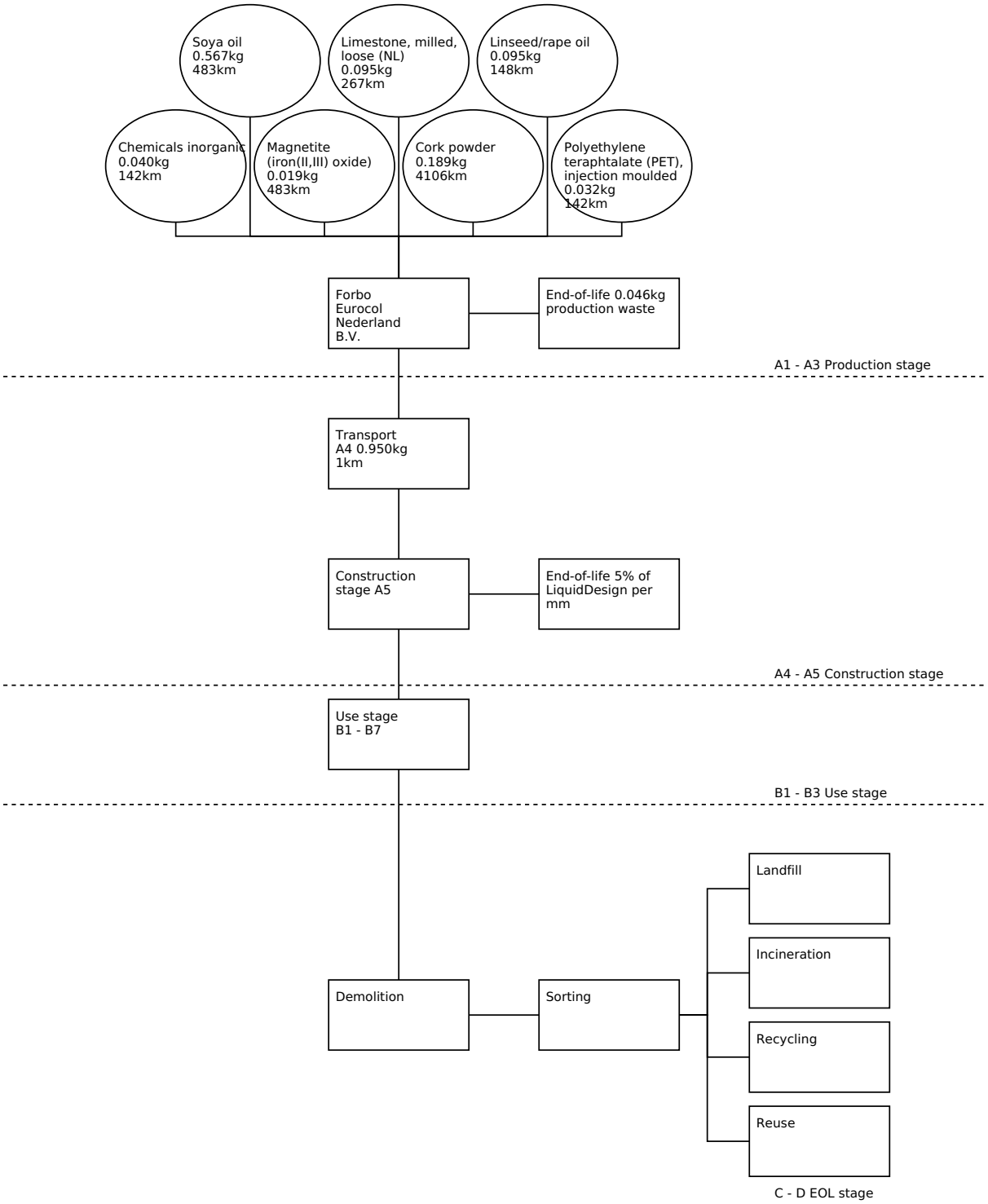
5.10 FINAL DISPOSAL (C1+C3+C4)

Material	End of life scenario	gewicht [kg]	% landfill	% incineration
1 mm¹ LiquidDesign (1mm thick, per m2)				
Limestone, milled, loose (NL)	organic material (via residue)	0.090	5%	95%
Cork powder	organic material (via residue)	0.180	5%	95%
Magnetite (iron(II,III) oxide)	organic material (via residue)	0.018	5%	95%
Linseed/rape oil	organic material (via residue)	0.090	5%	95%
Soya oil	organic material (via residue)	0.540	5%	95%
Raw Materials				
		0.918		

5.11 ENVIRONMENTAL COSTS AND BENEFITS OF RECYCLING AND REUSE (D)

Material	End of life scenario	gewicht [kg]	% recycling	% reuse
1 mm¹ LiquidDesign (1mm thick, per m2)				
Limestone, milled, loose (NL)	organic material (via residue)	0.090	0%	0%
Cork powder	organic material (via residue)	0.180	0%	0%
Magnetite (iron(II,III) oxide)	organic material (via residue)	0.018	0%	0%
Linseed/rape oil	organic material (via residue)	0.090	0%	0%
Soya oil	organic material (via residue)	0.540	0%	0%
Raw Materials				
		0.918		

5.12 PRODUCT FLOW DIAGRAM



6. RESULTS

6.1 ENVIRONMENTAL EFFECTS PER (SOLID PART)

Impact category	Unit	A1	A2	A3	A4	A5	B1	B2	B3	C2	C1+C3+C4	D	Total
ADPE	Kg Sb	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
ADPF	MJ	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
AP	Kg SO2 Equiv.	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
ODP	Kg CFC-11 Equiv.	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
GWP	Kg CO2 Equiv.	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
EP	Kg PO43- Equiv.	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
POCP	Kg Ethene Equiv.	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Parameter	**Unit**	**A1**	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**C2**	**C1+C3+C4**	**D**	**Total**
PERE	MJ	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
PERM	MJ	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
PERT	MJ	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
PENRE	MJ	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
PENRM	MJ	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
PENRT	MJ	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
SM	Kg	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
RSF	MJ	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
NRSF	MJ	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
FW	M3	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
HWD	Kg	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
NHWD	Kg	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
RWD	Kg	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
CRU	Kg	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
MFR	Kg	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
MER	Kg	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
EE	MJ	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
EET	MJ	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
EEE	MJ	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0

Impact categories: ADPE=Depletion of abiotic resources-elements | **ADPF**=abiotic depletion of fossil resources | **AP**=Acidification of soil and water | **ODP**=Ozone layer depletion | **GWP**=Global warming | **EP**=Eutrophication | **POCP**=Photochemical oxidants creation

Parameters: PERE=renewable primary energy ex. raw materials | **PERM**=renewable primary energy used as raw materials | **PERT**=renewable primary energy total | **PENRE**=non-renewable primary energy ex. raw materials | **PENRM**=non-renewable primary energy used as raw materials | **PENRT**=non-renewable primary energy total | **SM**=use of secondary material | **RSF**=use of renewable secondary fuels | **NRSF**=use of non-renewable secondary fuels | **FW**=use of net fresh water | **HWD**=hazardous waste disposed | **NHWD**=non hazardous waste disposed | **RWD**=radioactive waste disposed | **CRU**=Components for re-use | **MFR**=Materials for recycling | **MER**=Materials for energy recovery | **EE**=Exported energy | **EET**=Exported Energy Thermic | **EEE**=Exported Energy Electric

6.2 ENVIRONMENTAL EFFECTS PER (SCALABLE PART)

Impact category	Unit	A1	A2	A3	A4	A5	B1	B2	B3	C2	C1+C3+C4	D	Total
ADPE	Kg Sb	3.30E-6	2.07E-7	7.04E-7	3.54E-10	2.06E-7	0.00E+0	1.10E-5	0.00E+0	5.04E-8	1.63E-8	-9.31E-8	1.54E-5
ADPF	MJ	7.70E+0	1.12E+0	3.05E+0	1.92E-3	-3.38E-1	0.00E+0	5.36E+1	0.00E+0	2.74E-1	1.12E-1	-6.11E+0	5.94E+1
AP	Kg SO2 Equiv.	6.59E-3	3.23E-4	9.09E-4	5.52E-7	3.34E-4	0.00E+0	9.31E-3	0.00E+0	7.87E-5	1.76E-4	-4.75E-4	1.72E-2
ODP	Kg CFC-11 Equiv.	8.51E-8	1.36E-8	1.25E-8	2.33E-11	1.15E-9	0.00E+0	2.73E-7	0.00E+0	3.33E-9	1.19E-9	-3.33E-8	3.56E-7
GWP	Kg CO2 Equiv.	3.62E+0	7.33E-2	2.98E-1	1.25E-4	2.26E-1	0.00E+0	3.91E+0	0.00E+0	1.79E-2	1.71E-2	-3.64E-1	7.80E+0
EP	Kg PO43- Equiv.	7.81E-3	6.35E-5	4.58E-4	1.09E-7	4.09E-4	0.00E+0	1.62E-3	0.00E+0	1.55E-5	4.70E-5	-8.56E-5	1.03E-2
POCP	Kg Ethene Equiv.	2.17E-3	4.41E-5	1.87E-4	7.55E-8	1.11E-4	0.00E+0	7.39E-4	0.00E+0	1.08E-5	3.51E-5	-6.14E-5	3.24E-3
Parameter	**Unit**	**A1**	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**C2**	**C1+C3+C4**	**D**	**Total**
PERE	MJ	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
PERM	MJ	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
PERT	MJ	4.96E+1	1.56E-2	2.61E+0	2.66E-5	2.46E+0	0.00E+0	6.21E+0	0.00E+0	3.80E-3	3.62E-3	-1.04E+0	5.98E+1
PENRE	MJ	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
PENRM	MJ	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
PENRT	MJ	8.04E+0	1.21E+0	3.34E+0	2.06E-3	-3.10E-1	0.00E+0	5.24E+1	0.00E+0	2.94E-1	1.16E-1	-6.06E+0	5.90E+1
SM	Kg	1.80E-1	0.00E+0	9.00E-3	0.00E+0	9.45E-3	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.98E-1
RSF	MJ	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
NRSF	MJ	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
FW	M3	1.47E-1	2.18E-4	7.92E-3	3.73E-7	7.69E-3	0.00E+0	4.80E-2	0.00E+0	5.32E-5	8.77E-4	-9.12E-4	2.10E-1
HWD	Kg	4.49E-5	8.44E-6	3.20E-5	1.44E-8	1.37E-6	0.00E+0	2.26E-4	0.00E+0	2.06E-6	6.87E-7	-2.24E-5	2.93E-4
NHWD	Kg	1.41E-1	6.88E-2	2.74E-2	1.18E-4	2.33E-2	0.00E+0	5.08E-1	0.00E+0	1.68E-2	1.45E-1	-1.10E-2	9.19E-1
RWD	Kg	3.56E-5	7.76E-6	8.11E-6	1.33E-8	1.20E-6	0.00E+0	1.18E-4	0.00E+0	1.89E-6	4.73E-7	-1.12E-5	1.62E-4
CRU	Kg	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
MFR	Kg	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.67E-3	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.67E-3
MER	Kg	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
EE	MJ	0.00E+0	0.00E+0	1.86E-1	0.00E+0	5.68E-1	0.00E+0	1.24E+0	0.00E+0	0.00E+0	0.00E+0	3.71E+0	5.71E+0
EET	MJ	0.00E+0	0.00E+0	9.82E-2	0.00E+0	3.01E-1	0.00E+0	6.57E-1	0.00E+0	0.00E+0	0.00E+0	1.96E+0	3.02E+0
EEE	MJ	0.00E+0	0.00E+0	8.73E-2	0.00E+0	2.67E-1	0.00E+0	5.84E-1	0.00E+0	0.00E+0	0.00E+0	1.75E+0	2.69E+0

Impact categories: ADPE=Depletion of abiotic resources-elements | **ADPF**=abiotic depletion of fossil resources | **AP**=Acidification of soil and water | **ODP**=Ozone layer depletion | **GWP**=Global warming | **EP**=Eutrophication | **POCP**=Photochemical oxidants creation

Parameters: PERE=renewable primary energy ex. raw materials | **PERM**=renewable primary energy used as raw materials | **PERT**=renewable primary energy total | **PENRE**=non-renewable primary energy ex. raw materials | **PENRM**=non-renewable primary energy used as raw materials | **PENRT**=non-renewable primary energy total | **SM**=use of secondary material | **RSF**=use of renewable secondary fuels | **NRSF**=use of non-renewable secondary fuels | **FW**=use of net fresh water | **HWD**=hazardous waste disposed | **NHWD**=non hazardous waste disposed | **RWD**=radioactive waste disposed | **CRU**=Components for re-use | **MFR**=Materials for recycling | **MER**=Materials for energy recovery | **EE**=Exported energy | **EET**=Exported Energy Thermic | **EEE**=Exported Energy Electric

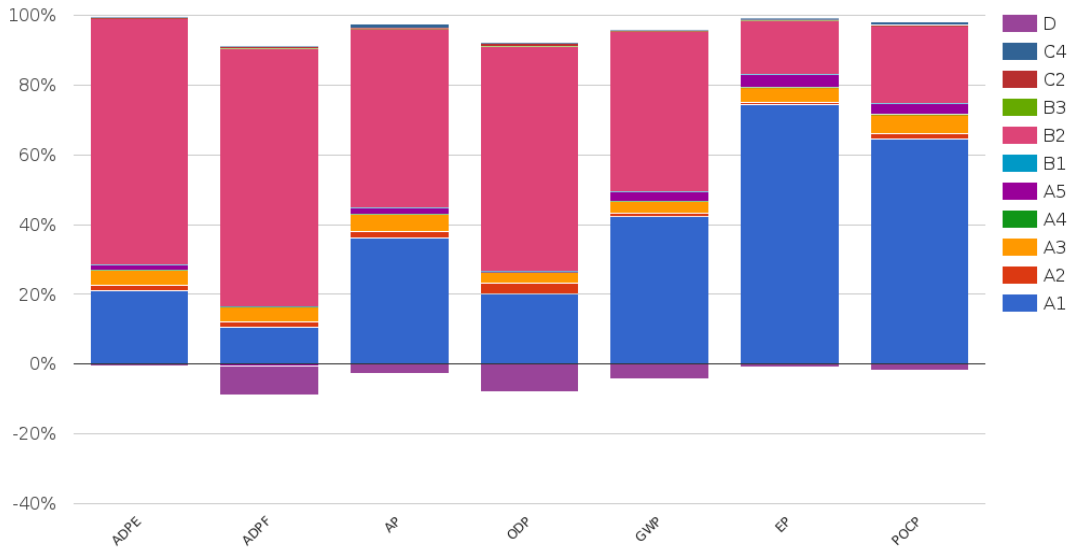
Combustion emissions and emissions from waste treatment for recovery and / or recycling are included in C4.

6.3 SHADOWPRICES PER FUNCTIONAL UNIT ()

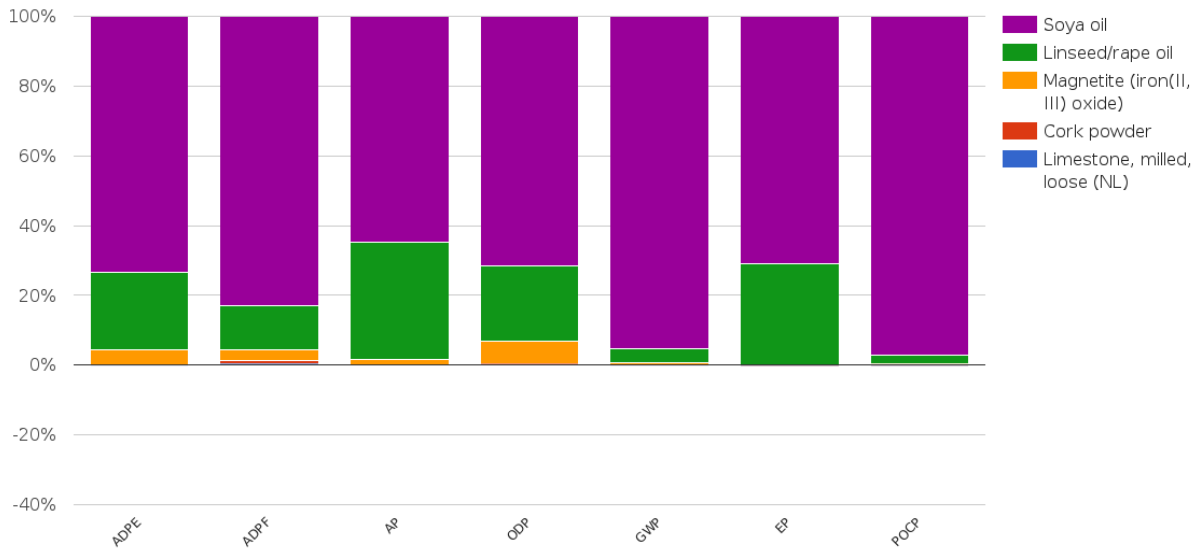
Phase EN15804	Shadow price per phase	Share in total
A1 Raw Materials Supply	s€ 0,28	50.2 %
A2 Transport	s€ 0,01	1.0 %
A3 Manufacturing	s€ 0,02	4.1 %
A4 Transport from the gate to the site	s€ 0,00	0.0 %
A5 Assembly	s€ 0,02	2.9 %
B1 Use	s€ 0,00	0.0 %
B2 Maintenance	s€ 0,25	44.9 %
B3 Replacements	s€ 0,00	0.0 %
C2 Transport	s€ 0,00	0.2 %
C4 Disposal	s€ 0,00	0.4 %
D Reuse/Reovery/Recycling potential	s€ -0,02	-3.8 %
Shadowprice per functional unit	**s€ 0,56**	

7. INTERPRETATION

7.1 CONTRIBUTION ANALYSIS OF THE STAGES

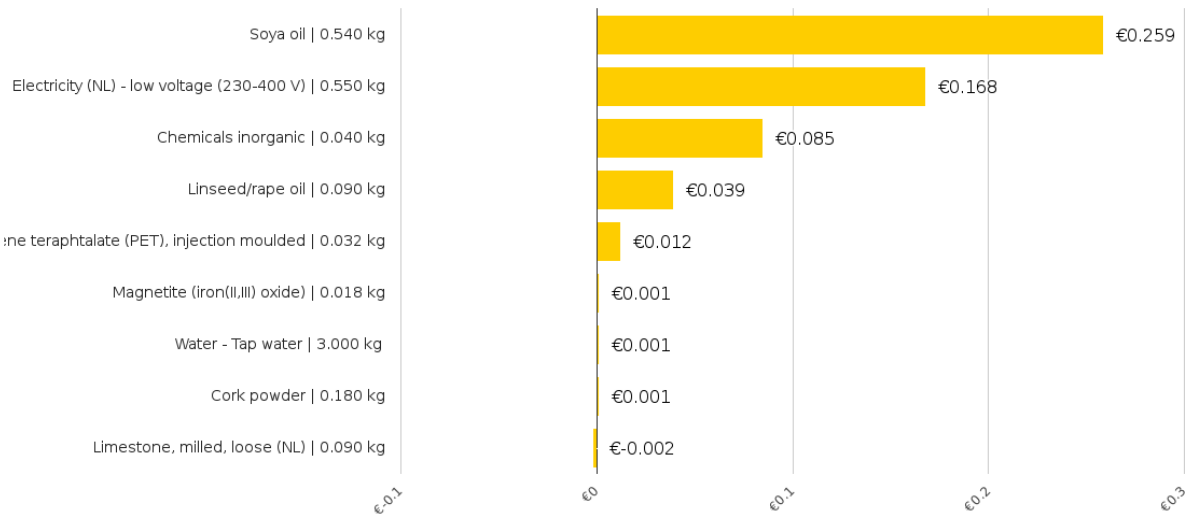


7.2 CONTRIBUTION ANALYSIS OF THE RAW MATERIALS (A1)



7.3 CONTRIBUTION ANALYSIS OF THE RAW MATERIAL (A1-D)

The following diagram shows the contribution of the raw materials, expressed in schadowprice / Environmental Cost Indicator.



ANNEX 1: DATA QUALITY

A1.1 TIME PERIOD DATA COLLECTION

2018

A1.2 DATA QUALITY QUANTITIES

Description	Material	Data quality	Data source
Calcium carbonate	Limestone, milled, loose (NL)	measured	Forbo Eurocol
Cork flour	Cork powder	measured	Forbo Eurocol
Ferric oxide	Magnetite (iron(II,III) oxide)	measured	Forbo Eurocol
Linseed oil	Linseed/rape oil	measured	Forbo Eurocol
Vegetable oil	Soya oil	measured	Forbo Eurocol
20L emmer (per liter)	Polyethylene teraphtalate (PET), injection moulded	estimated	Forbo Eurocol
Cleaning solution	Chemicals inorganic	average product	PCR Inside/Inside
Energieverbruik	Electricity (NL) - low voltage (230-400 V)	average product	PCR Inside/Inside
water	Water - Tap water	average product	PCR Inside/Inside

A1.3 APPROACH OF SUPPLIERS FOR LCA DATA

Supplier	supplier approached for company-specific environmental data?	manner in which the supplier is approached	Received document type
Sibelco	yes	by letter/email	
JPS Cork	yes	by letter/email	
Bayer	yes	by letter/email	
Huntsman Holland	yes	by letter/email	
Quartzline	no		

A1.4 USED SOURCES FOR THIS EPD

Material	Processes used	Source	Third-party verified	Comments
Raw Materials profiles				
Chemicals inorganic	Chemical, inorganic {GLO}| production | Alloc Rec, U	EcoInvent 3.3/NIBE	yes	
Cork powder	NIBE cork powder	NMD/EcoInvent 3.3	no	
Limestone, milled, loose (NL)	NIBE Limestone, milled, loose, at plant NL	EcoInvent 3.3	no	CAS: 001317-65-3
Linseed/rape oil	SBK 132 Lijnzaadolie	NMD/EcoInvent 3.3	yes	
Magnetite (iron(II,III) oxide)	Magnetite {GLO}| production | Alloc Rec, U	EcoInvent 3.3	no	
Polyethylene teraphtalate (PET), injection moulded	NIBE - Polyethylene teraphtalate (PET), injection moulded	NIBE/EcoInvent 3.3	no	
Soya oil	Soybean oil, refined {GLO}| market for | Alloc Rec, U	EcoInvent 3.3	no	
Water - Tap water	SBK 282 water, verbruik	NMD/EcoInvent 3.3	yes	
Energy profiles				
Electricity (NL) - low voltage (230-400 V)	SBK elektriciteit, kWh, gemiddeld (low voltage)	NMD/EcoInvent 3.3	yes	
Waste profiles				
finishes (adhered to wood, plastic, metal) - C4	WNL0001C4 - finishes (adhered to wood, plastic, metal)	NMD/NIBE/EcoInvent 3.3	yes	
finishes (adhered to wood, plastic, metal) - D	WNL0001D - finishes (adhered to wood, plastic, metal)	NMD/NIBE/EcoInvent 3.3	yes	
no waste (empty scenario) - C4	WNL0009C4 - no waste (empty scenario)	NMD/NIBE/EcoInvent 3.3	yes	
no waste (empty scenario) - D	WNL0009D - no waste (empty scenario)	NMD/NIBE/EcoInvent 3.3	yes	
organic material (via residue) - C4	WNL0025C4 - organic material (via residue)	NMD/NIBE/EcoInvent 3.3	yes	

Material	Processes used	Source	Third-party verified	Comments
organic material (via residue) - D	WNL0025D - organic material (via residue)	NMD/NIBE/EcoInvent 3.3	yes	
polyolefines (i.a. pe,pp) (i.a. pipes, foils) - C4	WNL0029C4 - polyolefines (i.a. pe,pp) (i.a. pipes, foils)	NMD/NIBE/EcoInvent 3.3	yes	
polyolefines (i.a. pe,pp) (i.a. pipes, foils) - D	WNL0029D - polyolefines (i.a. pe,pp) (i.a. pipes, foils)	NMD/NIBE/EcoInvent 3.3	yes	

ANNEX 2: REFERENCES

ISO 14040
DIN EN ISO 14040:2006-10, Environmental management - Life cycle assessment - Principles and framework; EN ISO 14040:2006

ISO 14044
DIN EN ISO 14044:2006-10, Environmental management - Life cycle assessment - Requirements and guidelines; EN ISO 14040:2006

ISO 14025
DIN EN ISO 14025:2011-10: Environmental labels and declarations — Type III environmental declarations — Principles and procedures

EN 15804
EN 15804:2012-04+A1 2013: Sustainability of construction works — Environmental Product Declarations — Core rules for the product category of construction products

SBK-verification protocol
SBK-verification protocol – inclusion data in the Dutch environmental database, Final Version 2.0, November 2014, SBK

SBK-Assessment Method
Assessment Method Environmental Performance Construction and Civil Engineering Works (GWW), Version 2.0 Definitive November 2014, SBK

Protocol EPD-online
25011.16.03.015 - Protocol EPD online - NMD, version 1.2, November 2016, NIBE