ENVIRONMENTAL PRODUCT DECLARATION

as per ISO 14025 and EN 15804

Owner of the Declaration	**BASF SE**
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-BAS-20160124-IAB1-EN
Issue date	16.08.2016
Valid to	15.08.2021

MasterSeal 345
BASF SE

Institut Bauen und Umwelt e.V.

www.bau-umwelt.com / https://epd-online.com

1. General Information

BASF SE

Programme holder
IBU - Institut Bauen und Umwelt e.V.
Panoramastr. 1
10178 Berlin
Germany

Declaration number
EPD-BAS-20160124-IAB1-EN

This Declaration is based on the Product Category Rules:
Building sealants, 07.2014
(PCR tested and approved by the SVR)

Issue date
16.08.2016

Valid to
15.08.2021

Prof. Dr.-Ing. Horst J. Bossenmayer
(President of Institut Bauen und Umwelt e.V.)

Dr. Burkhart Lehmann
(Managing Director IBU)

MasterSeal 345

Owner of the Declaration
BASF SE
Carl-Bosch-Straße 38
D-67056 Ludwigshafen

Declared product / Declared unit
1 kg MasterSeal 345

Scope:
This declaration and its LCA study are relevant to MasterSeal 345 manufactured at a single site by BASF SE in USA from a contractor. The owner of the declaration shall be liable for the underlying information and evidence; the IBU shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.

Verification

The CEN Norm /EN 15804/ serves as the core PCR
Independent verification of the declaration according to /ISO 14025/
☐ internally ☒ externally

Matthias Schulz
(Independent verifier appointed by SVR)

2. Product

2.1 Product description
MasterSeal 345 is an ethylene vinyl acetate (EVA) polymer-based, sprayable membrane. It is a one-component solution which is applied together with water by means of dry spraying (typical water addition 50% by weight).

2.2 Application
MasterSeal 345 is used for waterproofing underground concrete structures. It is spray-applied in a sandwich structure between two sprayed concrete/cast concrete layers, creating a double bonded composite shell lining. It is flexible and has very high bond strength properties on both sides of the membrane.

2.3 Technical Data

Constructional data

Name	Value	Unit
Density	1250	kg/m³
Resilience (EN ISO 7389)	*	%
Volume depletion (EN ISO 10563)	*	%
Vertical stability	*	mm
Tensile properties (EN ISO 8339)	*	-
Tensile properties prestressed (EN ISO 8340)	*	-
Adhesive- / expansion behavior at different temperatures (EN ISO 9047)	*	%
Adhesive- / expansion behavior prestressed after immersion in water (EN ISO 10590)	*	%
Adhesive- / expansion behavior after immersion in water (EN ISO 10591)	*	%
Application thickness	3 - 6	mm
Application temperature	+5 - +40	°C
Water pressure resistance (max)	15	bar
Failure stress (+20°C, 28 days)	1.5 – 3.5	MPa
Failure strain (+20°C, 28 days)	>100	%
Bond strength to concrete (28 days)	1.2 ± 0.2	MPa
Shore hardness (28 days)	80 ± 5	-

* These characteristics are not relevant for MasterSeal 345.

2.4 Placing on the market / Application rules
For the placing on the market no harmonization rules apply; therefore the product may not be CE-marked.

MasterSeal 345 is applied according to the rules specified in the /ITAtech Guideline/ for spray-applied waterproofing membranes.

2.5 Delivery status
MasterSeal 345 is available in 20 kg plastic bags (50 bags on a pallet).

2.6 Base materials / Ancillary materials

MasterSeal 345 is an ethylene vinyl acetate (EVA) polymer-based membrane (about 75%). Further ingredients of the product are reactive and non-reactive fillers. For the application MasterSeal 345 is mixed with water at the spraying nozzle (typical water addition 50% by weight).

2.7 Manufacture

For the production batch mixing of the needed ingredients is used. The raw materials are added into a pan mixer and transported after mixing to a filling station.

2.8 Environment and health during manufacturing

During production of MasterSeal 345 the dust is extracted and collected via a filter in order to avoid contamination of the environment. Thus any release of powder or dust to the environment is avoided. The production process is completely dry so that no waste water is generated. Equipment cleaning is also done without water. Empty bags of the raw materials are disposed of according to local regulations.

2.9 Product processing/Installation

An explosion protection concept is developed for the process and the manufacturing plant. Measures to avoid dust explosions in the manufacturing facility are implemented. The equipment for the manufacturing of MasterSeal 345 is designed according to the requirements of the explosion protection concept.

2.10 Packaging

MasterSeal 345 is available in 20 kg polyethylene plastic bags (50 bags on an EUR flat pallet). The empty bags are disposed of according to local regulations.

2.11 Condition of use

MasterSeal 345 has a shelf life of 12 months if stored in original, unopened bags between +5 °C to +40°C. The product must be kept out of direct sunlight. The storage area must be kept dry.
For the application of MasterSeal 345 the ambient temperature should be above +5 °C.

2.12 Environment and health during use

During use normally no relationships between MasterSeal 345 and the environment and health occur.

2.13 Reference service life

Reference service life is not relevant due to cradle-to-gate boundary conditions.

2.14 Extraordinary effects

Fire

MasterSeal 345 is located between two concrete layers and thus not directly exposed to fire. Therefore, it does not have specific fire protection properties. At high temperatures (above approx. 250 °C) it decomposes.

Water

After curing, the product water has no effect on it, because MasterSeal 345 is a waterproofing membrane. Tests have shown that there is no leaching of substances from MasterSeal 345 to water. It can also be used in direct contact with potable water.

Mechanical destruction

Not relevant, because MasterSeal 345 is installed in a sandwich construction between two concrete layers.

2.15 Re-use phase

Not relevant, because it cannot be re-used.

2.16 Disposal

If applied as intended and cured, the product is a layer between two concrete layers and will not be disposed of separately. It will be disposed together with the concrete, if that is disposed of.
Bags with unused product that has exceeded its shelf life and is not usable anymore have to be disposed of according to local regulations (waste code 08 04 10 according to /European waste catalogue/).

2.17 Further information

http://www.master-builders-solutions.basf.com/en-basf

3. LCA: Calculation rules

3.1 Declared Unit

Declared unit

Name	Value	Unit
Density (as declared)	1250	kg/m^3
Declared unit	1	kg

3.2 System boundary

Type of the EPD: Cradle-to-gate - with options

The modules considered in the Life Cycle Assessment are:

- A1: Raw materials supply
- A2: Transport to manufacturer
- A3: Manufacturing
- A4: Transport to construction site
- A5: Installation
- D: Reuse, recovery or recycling potential

3.3 Estimates and assumptions

All inputs and outputs of the production in Eddyville, Kentucky, USA, were considered in the calculation. Generic data was used for the considered raw materials due to the fact that these materials are not produced by BASF SE or its contractors. Assumptions were made for modules A4, A5 and D. For all raw material as well as packaging material, transport distances of 500 km by lorry (EURO 5, 18.4 t payload capacity, 85% utilization) were assumed. Transport to the construction site was derived according to distances to the main global sales regions (transportation mode and distance depends on the global sales figures for 2015). Credits for the avoided production of electricity and steam in another product system, due to the incineration of the packaging materials, were considered.

3.4 Cut-off criteria
All primary data of the production processes was considered. No cut-off criteria was used.

3.5 Background data
In order to calculate the life cycle of the declared MasterSeal 345 of BASF SE, the software solution GaBi ts 7.2 of thinkstep AG was used. Only background data from the GaBi ts 7.2 software were considered in this life cycle assessment to ensure the comparability of the results.

3.6 Data quality
Data quality is considered to be high. The last revision of the data was less than 3 years ago according to thinkstep AG.

3.7 Period under review
The period under review is 2015. All in-house data were collected for this period.

3.8 Allocation
During the production of MasterSeal 345 no co-products occur, therefore, no allocation was necessary. All credits from exported energy from packaging waste incineration are allocated to module D.

3.9 Comparability
Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to /EN 15804/ and the building context, respectively the product-specific characteristics of performance, are taken into account.

4. LCA: Scenarios and additional technical information

The following technical information is a basis for the declared modules or can be used for developing specific scenarios in the context of a building assessment if modules are not declared (MND).

Transport to the construction site (A4) - by truck

Name	Value	Unit
Litres of fuel	35.8	l/100km
Transport distance	2500	km
Capacity utilisation (including empty runs)	85	%
Gross density of products transported	590	kg/m^3
Capacity utilisation volume factor	1	-

Transport to the construction site - by ship (A4)

Name	Value	Unit
Litres of fuel	11,120	l/100km
Transport distance	7,770	km
Capacity utilisation (including empty runs)	77	%
Gross density of products transported	590	kg/m³
Capacity utilisation volume factor	1	

Installation (A5)

Name	Value	Unit
Auxiliary	-	kg
Water consumption	0.00033	m³
Electricity consumption	0.005	kWh
Diesel consumption	0.03	l
Material loss	0.003	kg
Output substances following waste treatment on site	0.008	kg
Dust in the air	-	kg
VOC in the air	-	kg

5. LCA: Results

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE NOT DECLARED)

PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARIES
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	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	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT: 1 kg MasterSeal 345

Parameter	Unit	A1-A3	A4	A5	D
Global warming potential	[kg CO_2-Eq.]	1.62E+0	1.73E-1	2.94E-2	-1.31E-2
Depletion potential of the stratospheric ozone layer	[kg CFC11-Eq.]	2.61E-10	9.69E-13	2.34E-12	-3.79E-12
Acidification potential of land and water	[kg SO_2-Eq.]	3.47E-3	2.51E-3	9.34E-5	-2.23E-5
Eutrophication potential	[kg $(PO_4)^{3-}$-Eq.]	4.62E-4	2.87E-4	1.59E-5	-2.04E-6
Formation potential of tropospheric ozone photochemical oxidants	[kg ethene-Eq.]	5.57E-4	6.69E-5	1.31E-5	-2.13E-6
Abiotic depletion potential for non-fossil resources	[kg Sb-Eq.]	6.59E-6	9.25E-9	8.37E-9	-2.56E-9
Abiotic depletion potential for fossil resources	[MJ]	4.39E+1	2.26E+0	1.39E+0	-1.77E-1

RESULTS OF THE LCA - RESOURCE USE: 1 kg MasterSeal 345

Parameter	Unit	A1-A3	A4	A5	D
Renewable primary energy as energy carrier	[MJ]	1.17E+0	7.95E-2	8.99E-2	-2.12E-2
Renewable primary energy resources as material utilization	[MJ]	2.84E-2	0.00E+0	0.00E+0	0.00E+0
Total use of renewable primary energy resources	[MJ]	1.20E+0	7.95E-2	8.99E-2	-2.12E-2
Non-renewable primary energy as energy carrier	[MJ]	1.43E+1	2.27E+0	1.41E+0	-2.12E-1
Non-renewable primary energy as material utilization	[MJ]	3.13E+1	0.00E+0	0.00E+0	0.00E+0
Total use of non-renewable primary energy resources	[MJ]	4.56E+1	2.27E+0	1.41E+0	-2.12E-1
Use of secondary material	[kg]	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Use of renewable secondary fuels	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Use of non-renewable secondary fuels	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Use of net fresh water	[m^3]	5.11E-1	1.01E-2	1.78E-2	-1.76E-2

RESULTS OF THE LCA – OUTPUT FLOWS AND WASTE CATEGORIES: 1 kg MasterSeal 345

Parameter	Unit	A1-A3	A4	A5	D
Hazardous waste disposed	[kg]	8.13E-6	1.01E-7	1.02E-7	-8.63E-11
Non-hazardous waste disposed	[kg]	1.65E+0	9.39E-3	1.79E-2	-2.09E-2
Radioactive waste disposed	[kg]	6.69E-4	4.01E-6	8.99E-6	-1.38E-5
Components for re-use	[kg]	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Materials for recycling	[kg]	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Materials for energy recovery	[kg]	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Exported electrical energy	[MJ]	0.00E+0	0.00E+0	2.75E-2	0.00E+0
Exported thermal energy	[MJ]	0.00E+0	0.00E+0	8.98E-2	0.00E+0

6. LCA: Interpretation

To facilitate comprehension of the Life Cycle Assessment the aggregate indicators of the Life Cycle Inventory Analysis (LCIA) must be interpreted in a dominance analysis.

Main driver for the energy demand is the production phase (A1-A3, including transportation of raw materials) with a share of 93%. Especially the production of raw materials is crucial (98%). Thus, the production of ethylene vinyl acetate co-polymer with a share of ca. 98% has the highest impact. The transportation of raw materials has only a small influence of ca. 1% (A2).

About 91% of the energy demand during production occurs from packaging material production (A3). The remaining energy demand of A3 accrues from electricity demand. About 0.3% of the total energy demand can be accounted as credit for the avoided production of electricity and steam in another product system due to the plastic packaging incineration (D). The fresh water demand is dominated by the production phase (94%). Therefore, especially the production processes of ethylene vinyl acetate co-polymer (89%) and talc (8%) are relevant. A credit of 0.3% occurs due to the avoided production of electricity and steam in another product system.

The environmental impacts are classified into the above mentioned impact categories.

Main impact on the global warming potential occurs from production. Thus the production of ethylene vinyl acetate co-polymer (A1, 92%) is the main driver. During the production of one kg of ethylene vinyl acetate polymer CO2 emissions of 2.5 kg occur. Ethylene vinyl acetate polymer production is the main

driver for the depletion potential of the stratospheric ozone layer.
Acidification potential and eutrophication potential are mainly dominated by the production of ethylene vinyl acetate polymer.
Main driver for the respective formation potential of tropospheric ozone photochemical oxidants is the production phase (especially the production of polyethylene film).
Abiotic depletion potential for non-fossil resources is dominated by the demand of colemanite and ethylene vinyl acetate polymer.
The highest impact on the abiotic depletion potential for fossil resources comes from crude oil and natural gas needed for the production of ethylene vinyl acetate polymer (86%).
Due to the fact that MasterSeal 345 is sold on a global market, different sales scenarios (adaptation of transport modes and transport distances as well as different electricity mixes for product application) were used. The sales scenarios were calculated on the basis of the parameters in the following table. The results show that the choice of a sales region has a significant influence on the results (especially for the impact categories Acidification Potential and Eutrophication Potential). Nonetheless the results of the base case can be used as example for all MasterSeal 345 sales regions in the respective EPD.

	Global	Europe	Asia Pacific	Orient – Russia - Africa	North America
Truck transport [km]	2,500	2,500	3,700	3,000	1,000
Ship transport [km]	7,770	6,000	12,000	15,000	-
GWP	100%	-0.7%	+5.4%	+5.4%	-7.2%
ODP	100%	0.0%	-0.3%	-0.4%	-0.3%
AP	100%	-8.5%	+22.5%	+36.8%	-39.7%
EP	100%	-6.3%	+21.3%	+30.5%	-34.2%
POCP	100%	-4.7%	+7.0%	+18.3%	-14.7%
ADPE	100%	+0.1%	+0.2%	+0.1%	-0.1%
ADPF	100%	-0.3%	+2.8%	+2.6%	-3.5%

7. Requisite evidence

No requisite evidence is necessary.

8. References

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General principles
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Calculation Rules for the Life Cycle Assessment and Requirements on the Project Report: 2013-04

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Requirements on the EPD for Building sealants, Version 1.6, 2014-07

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Commission decision on the European list of waste (COM 2000/532/EC), 2000-05

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ITAtech Report No. 2, April 2013, ISBN No. 978-2-9700858-1-2

Publisher
Institut Bauen und Umwelt e.V.
Panoramastr. 1
10178 Berlin
Germany

Tel +49 (0)30 3087748- 0
Fax +49 (0)30 3087748- 29
Mail info@bau-umwelt.com
Web **www.bau-umwelt.com**

Programme holder
Institut Bauen und Umwelt e.V.
Panoramastr 1
10178 Berlin
Germany

Tel +49 (0)30 - 3087748- 0
Fax +49 (0)30 – 3087748 - 29
Mail info@bau-umwelt.com
Web **www.bau-umwelt.com**

Author of the Life Cycle Assessment
TÜV Rheinland LGA Products GmbH
Am Grauen Stein 29
51105 Köln
Germany

Tel +49 (0)911 655 5225
Fax +49 (0)911 655 5226
Mail service@de.tuv.com
Web **www.tuv.com**

Owner of the Declaration
BASF SE
Carl-Bosch-Straße 38
67056 Ludwigshafen
Germany

Tel +49 (0)621 60-0
Fax +49 (0)621 60-42525
Mail global.info@basf.com
Web **www.basf.com**