

# ENVIRONMENTAL PRODUCT DECLARATION

as per ISO 14025 and EN 15804

Owner of the Declaration	ONDULINE SA
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-OND-20160087-CAD1-EN
Issue date	07/09/2016
Valid to	06/09/2021

## Corrugated Bitumen Sheets and Tiles ONDULINE SA

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## General Information

### ONDULINE SA

#### Programme holder

IBU - Institut Bauen und Umwelt e.V.  
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Germany

#### Declaration number

EPD-OND-20160087-CAD1-EN

#### This Declaration is based on the Product Category Rules:

Corrugated bitumen materials for roofing and external wall cladding, 07.2014  
(PCR tested and approved by the SVR)

#### Issue date

07/09/2016

#### Valid to

06/09/2021

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

Dr. Burkhard Lehmann  
(Managing Director IBU)

### Corrugated Bitumen Sheets and Tiles

#### Owner of the Declaration

Onduline SA  
35 Rue Baudin 92300 Levallois-Perret France

#### Declared product / Declared unit

Corrugated bitumen sheets and tiles/1m<sup>2</sup>

#### Scope:

This Life Cycle Assessment study is relevant for corrugated bitumen sheets and tiles produced in the manufacturing plants of Onduline-SA located in Brazil, France, Malaysia, Poland, Russia, Spain, Turkey and United States. This EPD is prepared as a weighted average product as calculated from overall production in these plants. In this study, the data collected refers to the year 2014. The LCA results are reported as 1m<sup>2</sup> corrugated bitumen sheet and tile average product.

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

Mr Carl-Otto Neven  
(Independent verifier appointed by SVR)

## Product

### Product description

**Onduline Corrugated Bitumen Sheets** are for pitched roofs and external walls, consisting of a homogenous base sheet composed of cellulose fiber that is recycled from all sources of waste paper and cardboard. The sheets are pre-pigmented with resin and coloring and impregnated with bitumen, a residue of petroleum refineries, under pressure and heat. This surplus material is used to give the sheet its characteristics of waterproofness. It is produced in a variety of colors. It has large dimensions, lightweight and is easy to install.

**Onduvilla Corrugated Bitumen Tiles** are small elements composed of a bitumen saturated reinforcement made of cellulose and mineral fillers, colored on the external size by a coating or a paint system with or without granules or fine flakes. These products have an overall rectangular shape and at least three corrugations. To be named as a corrugated bitumen sheet according to /EN 534:2006+A1:2010 Corrugated bitumen sheets — Product specification and test methods/, a product has to have an overall rectangular shape and at least 3 corrugations.

### Application

Onduline Corrugated Bitumen Sheets and Onduvilla Corrugated Bitumen Tiles are intended for use as discontinuously laid roof coverings and external wall finishes and their main function is to get watertightness on pitched roofs and walls. It can be fixed on wooden or metallic battens and purlins but also on full decks. The type of the substructure has to be chosen according to the shape of the roof. It should be laid onto substructure staggered and overlapped. It is intended to be used for protection from weathering elements such as rain water, snow, UV radiation and alike. The watertightness is ensured by the overlapping of the tiles. The corrugated Bitumen Sheets and Tiles can be combined with several insulation systems.

### Technical Data

Onduline Corrugated Bitumen Sheets are produced and delivered according to the requirements of the standard /EN 534/. The main specifications and the test methods are listed below:

TEST or CONTROL METHOD	TOLERANCE	TARGET VALUE
Visible defects EN 534	-	CONFORM
Length EN 534 7.1.1 and 5.1.1	(+1%,-0,2%)	Varying between 100 – 200,7 cm
Width EN 534 7.1.2 and 5.1.2	(± 2%)	Varying between 76 – 121,9 cm
Thickness EN 534 7.1.3 and 5.1.3	(± 10%)	Varying between 2,6 – 3,5 mm
Height of corrugations EN 534 7.1.4 and 5.1.4	(± 6%)	Varying between 33 – 40 mm
Pitch of corrugations EN 534 7.1.5 and 5.1.5	(± 3%)	63,5; 95; 101,6 mm
Squareness EN 534 7.1.6 and 5.1.6	max	4 mm/m
Bending under downward load(1/200) EN 534 7.2.1 and 5.2.1	min	R=1400 N/m <sup>2</sup> S=700 N/m <sup>2</sup>
Impact strength EN 534 7.2.2 and 5.2.2	-	R=400mm S=250mm
Tearing strength EN 534 7.2.3 and 5.2.3	min	R=200 N S=150N
EN 534 7.4.1 and 5.4.1 (After ageing)	min	R=200 N S=150N
Water impermeability EN 534 7.3.1 and 5.3.1	-	CONFORM
EN 534 7.4.2 and 5.4.2 (After ageing)	-	CONFORM
Proportion of bitumen EN 534 7.3.2 and 5.3.2	min	40 %
Mass EN 534 7.3.3 and 5.3.3	(± 10%)	Varying between 2,56 – 3,88 kg/m <sup>2</sup>
Bitumen homogeneity EN 534 7.3.4 and 5.3.4	max	1 cm <sup>2</sup>
Water absorption 24 h EN 534 7.3.5 and 5.3.5	max	20 %
Thermal coefficient EN 534 7.4.3 and 5.4.3	max	100X10 <sup>-6</sup> 1/K
Reaction to fire EN 13501-1	-	E CLASS B Roof t1 for some products

Onduvilla Corrugated Bitumen Tiles are produced and delivered according to the requirements of the European Technical Approval /ETA-10/0018/. The main specifications and the test methods are listed below:

TEST or CONTROL METHOD	TOLERANCE	TARGET VALUE
Visible defects EN 534	-	CONFORM
Length ETA-10/0018 1.2.1	(± 20mm)	107 cm
Width ETA-10/0018 1.2.1	(± 5mm)	40 cm
Thickness ETA-10/0018 1.2.1	(±0,3mm)	3 mm (FR=3,2mm)
Height of corrugations ETA-10/0018 1.2.1	(±2mm)	38 mm
Pitch of corrugations ETA-10/0018 1.2.1 (corrugated +flat part)	(± 2mm)	195 mm
Squareness EN 534 7.1.6 and 5.1.6	max 4mm/m	0 mm/m
Bending under downward load(1/200) ETA-10/0018 2.5	-	NOT APPLICABLE
Impact strength ETA-10/0018 2.6	-	NOT APPLICABLE
Tearing strength ETA-10/0018 2.7; EN 534 5.2.3	min	200 N
ETA-10/0018 2.8; EN 534 5.4.1 (After ageing)	min	200 N
Water impermeability ETA-10/0018 2.4; EOTA TR 033	-	CONFORM
ETA-10/0018 2.9; EN 534 5.4.2 (After ageing)	-	CONFORM
Proportion of bitumen EN 534 7.3.2 and 5.3.2	min	40 %
Mass ETA-10/0018 1.2.1	(± 10%)	2,92 -3,15 kg/m <sup>2</sup>
EN 534 7.3.3 and 5.3.3		(FR:3,32-3,53 kg/m <sup>2</sup> )
Bitumen homogeneity EN 534 7.3.4 and 5.3.4	max	1 cm <sup>2</sup>
Water absorption 24 h EN 534 7.3.5 and 5.3.5	max	20 %
Thermal coefficient ETA-10/0018 2.10	max	NOT APPLICABLE
Reaction to fire ETA-10/0018 2.1 ; EN 13501-1	-	E CLASS Broof t1 for FR

## LCA: Calculation rules

### Declared Unit

The functional unit (FU) is the production of 1 m<sup>2</sup> corrugated bitumen sheet and tile products in line with PCR Part B document for corrugated bitumen materials for roofing and external wall cladding.

### Declared unit

Name	Value	Unit
Weight (weighted average value in 2014)	3.16	kg/m <sup>2</sup>
Conversion factor to 1 kg	0.3165	-
Declared unit	1	m <sup>2</sup>

### Base materials / Ancillary materials

The product components are waste paper / cardboard, bitumen, resin, pigment, binder, paint loads, kaolin, drainage agent, antifoaming agent/defoamer, dispersing agent, biocide and pH regulator.

Waste paper / cardboard: 48-58% (post-consumer recycled material content)

Bitumen: 40-50%

Resin: 1-3%

Others: approx. 4.5%

\*Products have no list of SVHC (Substances of Very High Concern). They do not release neither content hazardous substances.

### Packaging

The final products are put onto pallets and then shrink-wrapped with Low-Density Polyethylene (LDPE) and necessary registrations are done before the products are stored in the warehouse.

Wooden pallets, LDPE stretch film, etiquettes, posters, steel clips and band are used for packaging.

### Delivery Status

Onduline Corrugated Bitumen Sheets are delivered on pallets. One pallet includes 350 piece of sheets. Dimensions of pallets: 204 x 100 x 180 (±10).

Onduline Corrugated Bitumen Tiles are packaged in bundles, 10 pieces of tiles per bundle. Bundles are delivered on pallets, 81 bundles per pallet. Dimensions of pallets: 125 x 110 x 150 (±10).\*

\*size of the pallet may vary depending on the range/profile of sheets/tiles manufactured.

### Reference service life

Within the scope of this study only the product stage and the construction process stage information modules are declared. Since this EPD does not cover the whole life cycle of this product, the declaration of the reference service life is not mandatory.

### System boundary

Type of the EPD: cradle-to-gate

The system boundary contains A1 (extraction, processing, production of raw materials), A2 (Transport to the manufacturer and internal transport) and A3 (Manufacturing operations) modules. These are declared separately.

### Manufacturing

Manufacturing steps of corrugated bitumen sheets and tiles are defined in detail as following. For both, the manufacturing process is composed of two main sections:



**Cardboard production section:**

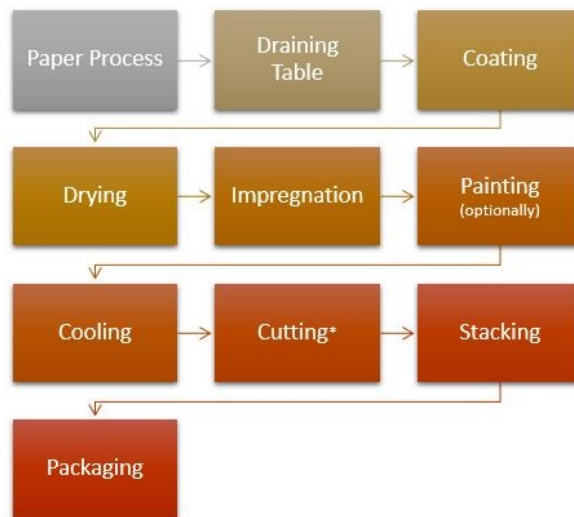
The incoming waste paper is turned into pulp by means of a pulper. This pulp is stocked in the homogenizing stock chests where the consistency is adjusted. During the transfers between the chests, cleaning, sorting, degassing and impurity separation processes are realized. The pulp (web) passes then onto a Fourdrinier (web forming machine) machine where the fibers of cellulose and fillers are distributed evenly at a flat forming table getting the shape of a cardboard with the required thickness and dimensions. Afterwards, it undergoes primary coating and corrugation processes. Coating is the generic name for application of color (resin and pigment base).

Drying is realized in a drying tunnel heated by natural gas to obtain a complete dryness in the final state. The cardboards are cut into required dimensions and become sheets before proceeding to the next stage.

**Impregnation Section:**

In this section, cardboard gains its waterproofing property. It is completely saturated with bitumen at high temperatures. After impregnation, the sheets undergo curing and cooling operations –corrugated bitumen tiles are cut to dimensions.

The manufacturing process is shown in below:



\*Cutting for corrugated bitumen tiles

**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.

**Further information**

For further information, please contact ONDULINE SA through its website at <http://www.onduline.com>

**LCA: Scenarios and additional technical information**

Within this LCA work, A4-A5, B1-B7, C1-C4 and D are not considered. There are no scenarios related to these stages.

**Additional Information Related to the Certifications**

Almost all the activities (purchasing, manufacturing, quality control, expeditions, etc.) are performed according to the requirements of /ISO 9001/ and /ISO 14001/standards (Except US plant).

The certificate for /ISO 9001/ standard has been first obtained in 1997 in France. France, Poland, Malaysia, Russia, Brazil, Spain and Turkey plants have /ISO 9001/ certificate.

The certificate for /ISO 14001/ standard has been first obtained in 2000 in France too. France, Brazil, Spain and Turkey plants have /ISO 14001/ certificate.

These certificates, periodically renewed, are still valid. The audits have been continuing since the beginning. Observation audits are performed every year, and certification audits are performed every 3 years. The latest certificate was achieved in 2015. The next update will be in 2018.

## 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	MND	MND	MND	MND	MNR	MNR	MNR	MND	MND	MND	MND	MND	MND	MND

### RESULTS OF THE LCA - ENVIRONMENTAL IMPACT: Corrugated bitumen sheets and tiles/1m2

Parameter	Unit	A1	A2	A3
Global warming potential	[kg CO <sub>2</sub> -Eq.]	1.03E+0	1.44E-1	3.13E+0
Depletion potential of the stratospheric ozone layer	[kg CFC11-Eq.]	3.96E-7	1.03E-8	3.52E-7
Acidification potential of land and water	[kg SO <sub>2</sub> -Eq.]	3.01E-3	6.45E-4	5.26E-3
Eutrophication potential	[kg (PO <sub>4</sub> ) <sup>3</sup> -Eq.]	1.10E-3	1.48E-4	1.92E-3
Formation potential of tropospheric ozone photochemical oxidants	[kg ethene-Eq.]	4.35E-4	2.14E-5	3.60E-4
Abiotic depletion potential for non-fossil resources	[kg Sb-Eq.]	7.47E-6	3.57E-7	3.25E-7
Abiotic depletion potential for fossil resources	[MJ]	7.56E+1	2.19E+0	4.80E+1

### RESULTS OF THE LCA - RESOURCE USE: Corrugated bitumen sheets and tiles/1m2

Parameter	Unit	A1	A2	A3
Renewable primary energy as energy carrier	[MJ]	0.00E+0	0.00E+0	0.00E+0
Renewable primary energy resources as material utilization	[MJ]	0.00E+0	0.00E+0	0.00E+0
Total use of renewable primary energy resources	[MJ]	0.00E+0	0.00E+0	0.00E+0
Non-renewable primary energy as energy carrier	[MJ]	8.42E+1	2.37E+0	5.26E+1
Non-renewable primary energy as material utilization	[MJ]	0.00E+0	0.00E+0	0.00E+0
Total use of non-renewable primary energy resources	[MJ]	8.42E+1	2.37E+0	5.26E+1
Use of secondary material	[kg]	1.93E+0	IND	IND
Use of renewable secondary fuels	[MJ]	IND	IND	IND
Use of non-renewable secondary fuels	[MJ]	IND	IND	IND
Use of net fresh water	[m <sup>3</sup> ]	1.93E-3	5.07E-5	2.74E-3

### RESULTS OF THE LCA – OUTPUT FLOWS AND WASTE CATEGORIES:

#### Corrugated bitumen sheets and tiles/1m2

Parameter	Unit	A1	A2	A3
Hazardous waste disposed	[kg]	6.91E-5	2.53E-6	4.09E-5
Non-hazardous waste disposed	[kg]	1.10E-1	1.26E-1	1.74E-1
Radioactive waste disposed	[kg]	4.86E-4	1.27E-5	1.05E-4
Components for re-use	[kg]	IND	IND	IND
Materials for recycling	[kg]	IND	IND	IND
Materials for energy recovery	[kg]	IND	IND	IND
Exported electrical energy	[MJ]	IND	IND	IND
Exported thermal energy	[MJ]	IND	IND	IND

### LCA: Interpretation

The life cycle impact assessment results are presented in three different categories; environmental impacts, resource use and waste generation.

Related environmental impacts category, manufacturing stage (A3) has the highest impact for global warming potential (**GWP**), acidification potential of land and water (**AP**), eutrophication potential (**EP**) than the other stages. In A3 stage, abiotic depletion (non-fossil fuels), abiotic depletion (fossil fuels), global warming potential, ozone layer depletion, photochemical oxidation and acidification are mostly attributed to natural gas; while eutrophication is caused by electricity.

Raw materials supply stage (A1) has the largest impact on the depletion potential of the stratospheric ozone layer (**ODP**), formation potential of tropospheric ozone photochemical oxidants (**POCP**), abiotic depletion potential for non-fossil resources (**ADPE**) and abiotic depletion potential for fossil resources (**ADPF**). Considering contribution of all environmental impacts within raw materials in the composition the most important contributors are bitumen, chromium oxide pigment and resin. Bitumen has the highest impact in all environmental impacts (except abiotic depletion non-fossil fuels). Eutrophication is caused mainly by resin and bitumen; whilst the abiotic depletion (non-fossil fuels) is mostly determined by chromium oxide pigment and resin.

Concerning the lowest environmental impact, transport stage (A2) has the lowest values in global warming potential, ozone layer depletion, acidification, eutrophication, photochemical oxidation and abiotic depletion (fossil fuels).

Related to the total energy requirement, the raw material supply stage has the highest energy demand. It is caused mainly by the upstream processes of bitumen. The raw materials are followed by manufacturing and transport, respectively. In the manufacturing stage, it is mostly caused by the background processes of natural gas.

Concerning total water consumption, manufacturing stage and raw material supply stage have the highest impact followed by the transport stage with only a small effect. Within the manufacturing stage, the water consumption is mainly linked to processes during production (such as pulp preparation, coating, paint and resin preparation and cooling, etc.). In the raw material supply stage, the water use is mainly coming from the upstream processes of bitumen.

Regarding the waste generation, the hazardous waste is mainly generated by the raw materials stage (mostly upstream processes of bitumen). The non-hazardous waste is mainly linked to upstream processes of manufacturing, transport and raw materials supply, respectively. Within manufacturing stage, it is related to the waste landfill and the upstream processes of natural gas, electricity; while in the raw materials supply stage, it is caused mainly by upstream processes of pigments and resin. The radioactive waste throughout the life cycle stages is mostly attributed to raw material supply stage. The value acquired for this type of waste is mostly in relation with the upstream processes of bitumen.

## References

### **Institut Bauen und Umwelt**

Institut Bauen und Umwelt e.V., Berlin(pub.):  
Generation of Environmental Product Declarations  
(EPDs);

### **General principles**

for the EPD range of Institut Bauen und Umwelt e.V.  
(IBU), 2013/04  
[www.bau-umwelt.de](http://www.bau-umwelt.de)

### **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

### **PCR Part A**

*Institut Bauen und Umwelt e.V.*, Berlin (pub.): Product  
Category Rules for Construction Products from the  
range of Environmental Product Declarations of Institut  
Bauen und Umwelt (IBU). Part A: Calculation Rules for  
the Life Cycle Assessment and Requirements on the  
Project Report (version 1.4), 10.09.2015; [www.bau-umwelt.de](http://www.bau-umwelt.de)

### **PCR Part B**

*Institut Bauen und Umwelt e.V.*, Berlin (pub.): Product  
Category Rules for Construction Products from the  
range of Environmental Product Declarations of Institut  
Bauen und Umwelt (IBU), Part B: Requirements on the  
EPD for corrugated bitumen materials for roofing and  
external wall cladding (version 1.6), 04.07.2014,  
[www.bau-umwelt.de](http://www.bau-umwelt.de)

### **ISO 14040-44**

DIN EN ISO 14040:2006: Environmental management  
- Life cycle assessment - Principles and framework  
(ISO 14040:2006) and Requirements and guidelines  
(ISO 14044:2006)

### **EN 534:2006+A1:2010**

Corrugated bitumen sheets-Product specification and  
test method

### **BS EN 13501-1:2007+A1:2009**

Fire classification of construction products and building  
elements - Part1: Classification using data from  
reaction to fire tests

### **ETA-10/0018**

Corrugated Bitumen Tiles – Onduvilla: 2015

### **ISO 9001 : 2008**

Quality management systems — Requirements

### **ISO 14001 : 2004**

Environmental management systems—Requirements  
with guidance for use.

### **Ecoinvent**

Ecoinvent Centre, [www.ecoinvent.org](http://www.ecoinvent.org)

### **SimaPro**

SimaPro LCA Package, Pré Consultants, the  
Netherlands, [www.pre-sustainability.com](http://www.pre-sustainability.com)

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