ENVIRONMENTAL PRODUCT DECLARATION

as per ISO 14025 and EN 15804

Owner of the Declaration	Eternit nv
Programme holder	Institut Bauen und Umwelt (IBU)
Publisher	Institut Bauen und Umwelt (IBU)
Declaration number	EPD-ETE-2013711-E
Issue date	17.06.2013
Valid to	16.06.2018

EQUITONE TECTIVA

Eternit nv

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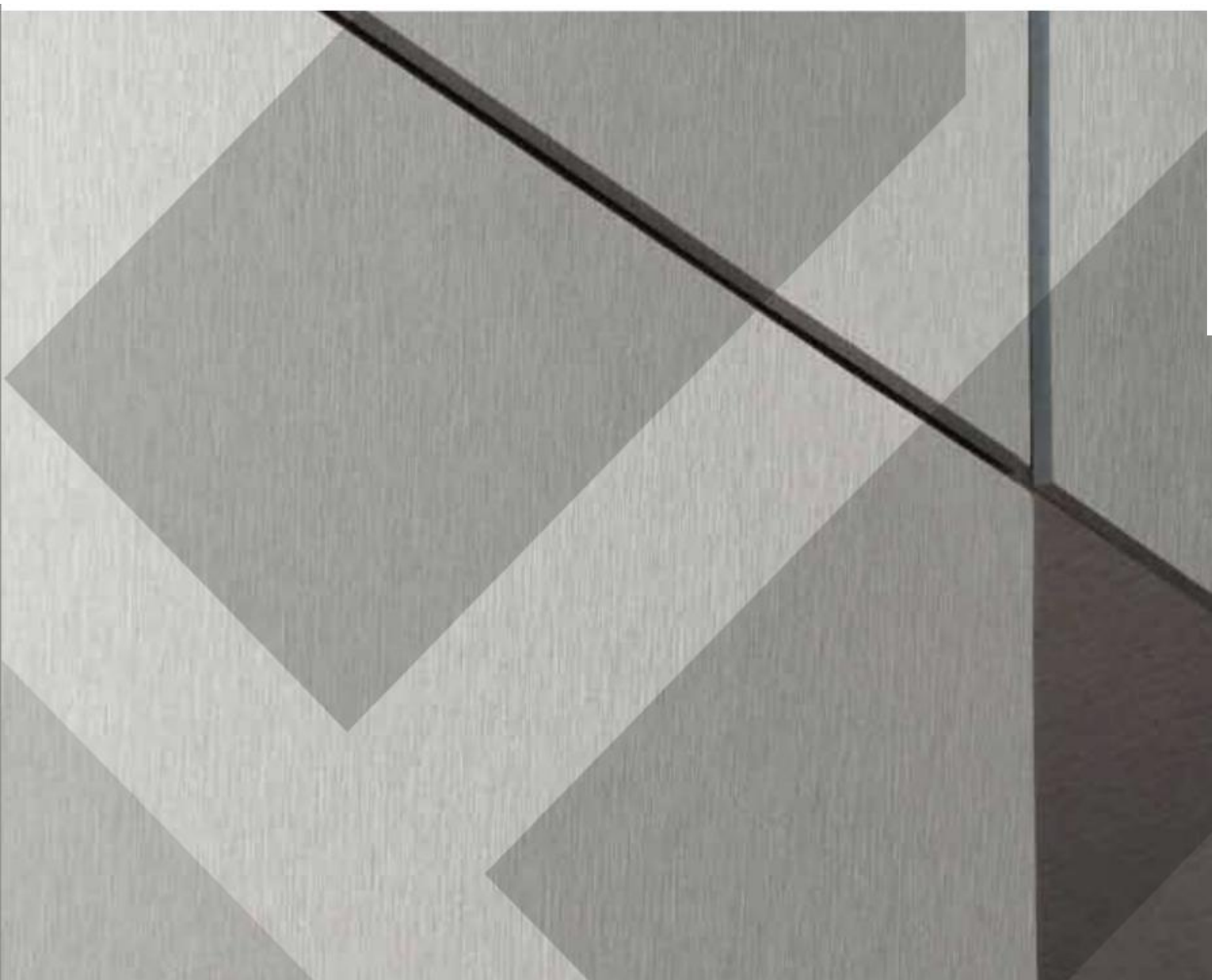

1 General information

ETERNIT NV	EQUITONE TECTIVA
Programme holder IBU - Institut Bauen und Umwelt e.V. Rheinufer 108 D-53639 Königswinter	**Owner of the Declaration** Eternit nv Kuiermansstraat 1 1880 Kapelle-op-den-Bos - Belgium
Declaration number EPD-ETE-2013711-E	**Declared product / Declared unit** 1 m^2 of EQUITONE TECTIVA fibre cement sheets in accordance with Eternit product use and installation recommendations (thickness=8mm).
This Declaration is based on the Product Category Rules: PCR Part B: Fibre cement / Fibre concrete 07-2011 (PCR tested and approved by the independent Committee of Experts (SVA))	**Scope:** This EPD covers the products range of EQUITONE TECTIVA fibre cement sheets manufactured by Eternit at Kapelle-op-den-Bos factory, Belgium. This product is sold in Europe and its mainly used as a cladding sheet for ventilated and insulated lightweight facade-systems. The owner of the declaration shall be liable for the underlying information and evidence.
Issue date 17.06.2013	
Valid to 16.06.2018	
Prof. Dr.-Ing. Horst J. Bossenmayer (President of Institut Bauen und Umwelt e.V.)	**Verification** The CEN standard EN 15804 serves as the core PCR. Verification of the EPD by an independent third party as per ISO 14025 ☐ Internally ☒ externally
Prof. Dr.-Ing. Hans-Wolf Reinhardt (Chairman of SVA)	Patricia Wolf (Independent tester appointed by SVA)

2 Product

2.1 Product description

The product covered by this EPD is the EQUITONE TECTIVA calcium silicate Eternit fibre cement sheet produced at Kapelle-op-den-Bos production plant, Belgium. It is mainly made of sand, cement, cellulose, wollastonite, clay and lime. This product is used as panel for exterior (and interior) walls covering.

This average product is representative of the following color range: TE00, TE 10, TE 20, TE 30, TE 40, TE 50, TE 60, TE 80 and TE 90.

Only pigment composition changes from a EQUITONE TECTIVA product to the other.

All products from this range:

- have been manufactured according to the same industrial process, especially the coating formula,
- have homogenous physical properties
- have the same density
- have been since 2007 in the European market
- have been produced in a unique factory (Kapelle-op-den-Bos) since 2007

2.2 Application

EQUITONE TECTIVA product is mainly used as a cladding sheet for ventilated exterior claddings and ceilings and insulated lightweight facade-systems . The board itself is fixed to a backstructure in wood or metal. This backstructure is mounted on a supporting wall in a massive construction (such as bricks, concrete, ...), lightweight skeleton (steel, wood) or prefabricated solutions. The application field is new construction and renovation of low, middle high and high rise buildings.

In a minor application, the EQUITONE TECTIVA can be used as protection for insulated foundations.

The EQUITONE TECTIVA can also be used in interior decorative apllications for walls and ceilings.

2.3 Technical Data

The following table includes the testing methods average values according to the European standard

EN 12467:2004 + A1:2005 + A2:2006 ‘Fibre-cement flat sheets’.

A. Testing according to ISO quality management system				
Density	Dry	EN 12467	1,580	kg/m³
Bending strength	Ambient, ⊥	EN 12467	32.0	N/mm²
	Ambient, //	EN 12467	22.0	N/mm²
Modulus of elasticity	Ambient, ⊥	EN 12467	> 14,000	N/mm²
	Ambient, //	EN 12467	> 12,000	N/mm²
Hygric movement	0-100%, mean		1.60	mm/m
Porosity	0-100%		< 25	%
B. Classification				
Durability classification		EN 12467	Category A	
Strength classification		EN 12467	Class 4	
Fire reaction		EN 13501-1	A2-s1-d0	
C. Type test or best estimate				
Impermeability test		EN 12467	Ok	
Warm water test		EN 12467	Ok	
Soak dry test		EN 12467	Ok	
Freeze thaw test		EN 12467	Ok	
Thermal expansion coefficient	α		< 0,01	mm/mK
Thermal conductivity	λ		0.390	W/mK

2.4 Placing on the market / Application rules

For now, no standard application rules are applied in Europe. Product has to be installed according to EQUITONE TECTIVA guidelines. For the placing on the market the product specification EN 12467:2004 + A1:2005 + A2:2006 'Fibre-cement flat sheets' is valid.

2.5 Delivery status

The fibre cement sheets are transported by road using wooden pallets. They are packaged on wooden pallets covered with cardboards fixed with high density polyethylene. In order to carry 1 m² of EQUITONE TECTIVA product (thickness=8mm),

The sheets are packaged on pallets. They are to be transported by trucks.

The product is delivered within the following standard dimensions:

Thickness: 8 mm
Not rectified: 1 240 x 2 520 mm, 1 240 x 3 070 mm

Rectified: 1 220 x 2 500 mm, 1 220 x 3 050
Humid weight: 14,9 kg/m2 (with 15% humidity)

Dry weight: 12,64 kg/m2

Thicknesses, sizes and types of the sheets which differ from those available as standard from stock are available but subjected to minimum order quantities.

2.6 Base materials / Ancillary materials

EQUITONE TECTIVA products are made out of the following components:

- sand (>30% of main raw materials and additives)
- cement (>30%)
- cellulose (<10%)
- pigments (<10%)
- wollastonite (<10%)
- clay (<10%)
- lime (<10%)

2.7 Manufacture

EQUITONE TECTIVA sheets are manufactured on a Hatschek machine. They are double pressed, autoclaved, calibrated and polished.

Afterwards EQUITONE TECTIVA is made water repellent on front and back by means of a hydrofobation.

2.8 Environment and health during manufacturing

Eternit company is committed to a global approach in order to improve its environmental performance. All production sites are ISO 14001:2004 and OHSAS 18001:2007 certified.

2.9 Product processing / Installation

During the mechanical machining of panels, dust can be released which can irritate the airways and eyes. Adequate machinery with dust extraction and/or ventilation should be foreseen. If dust extraction is not efficient, dust masks of type FFP2 or better according EN149:2001 should be used.

The following tools and accessories are used for processing and installation:

-Cutting/Sawing: Circular saw, Jigsaw, sandpaper

-Drilling: carbide-tipped twist drill (or completely in carbide), sandpaper

-Fastening accessories: Screws, Rivets, Adhesive

Apart from this, the inhalation of fine (respirable size) quartz containing dust, particularly when in high concentrations or over prolonged periods of time can lead to lung disease and an increased risk of lung cancer. Depending on the working conditions, adequate machinery with dust extraction and/or ventilation should be foreseen.

2.10 Packaging

Sheets are packaged on pallets and are to be transported and stored in a covered dry area.

In order to carry 1 m² of EQUITONE TECTIVA product (thickness=8mm), the following amounts of packaging elements are necessary:

- Pallets : 36 g/declared unit

- Cardboard: 1,28 g/declared unit- high density polyethylene: 0,66 g/ declared unit

2.11 Condition of use

EQUITONE TECTIVA does not require special maintenance. EQUITONE TECTIVA is resistant to chipping, impact, mold and termites.

For minor soiling, washing is required with a mild household detergent or soft soap solution followed by rinsing with clear water.

2.12 Environment and health during use

There is no specific recommendation for this product.

2.13 Reference service life

Reference service life (RSL) for this product is 60 years.

2.14 Extraordinary effects

Fire

According to EN 13501-1+A1: 2007 and EN 12467:prA2:2004, EQUITONE TECTIVA product classification in relation to its reaction to fire behavior is A2.

Smoke production classification is s1.

Flaming droplets classification is d0.

According to the latest classification report following EN 13501-1+A1:2007 and EN 12467:prA2:2004 standards (EN12467:2013 is currently under validation), heat of combustion of EQUITONE TECTIVA is: 1,2 MJ/kg.

Water

Due to the fact that EQUITONE TECTIVA is an inert material, there is no environmental effect with contact with water.

This has been proved by the Flamisch Institute for Technologic Research "VITO". They have done a lot of tests on different fibre-cement products concerning possible effects on the environment for the paramaters which exceeded the normal european values for inert waste, such as TOC, DOC and TDS.

Mechanical destruction

Due to the fact that the EQUITONE TECTIVA sheet is considered as an inert material, there is no effect on the environment.

2.15 Re-use phase

EQUITONE TECTIVA product can be re-used and fully recycled.

See Redco report TR_2012_088_Redco; expert study on the use of fibre cement products as raw material for the production of cement clinker.

2.16 Disposal

The waste code in accordance with the European Waste Index is 17.09.04

2.17 Non re-used or recycled waste products are disposed in sanitary landfills. Further information

Technical sheet available on the Eternit “download center” available at the following address:

http://www.eternit.be/

3 LCA: Calculation rules

3.1 Declared unit

According to **ISO 14025 and EN 15804**, the **declared unit** agreed upon and related to the key function of the product is as follows:

“Produce 1 m^2 of EQUITONE TECTIVA fibre cement sheets in accordance with Eternit product use and installation recommendations (thickness=8mm).”

The humid mass reference related to the declared unit is 14,9 kg which is the weight of the reference product used for this study. This mass reference excludes the screws (0,025 kg per declared unit), the EPDM (0,24 kg per declared unit) joints and aluminium profile joints (0,07 kg per declared unit) commonly used to implement the EQUITONE TECTIVA. Nevertheless, screws, EPDM joints and aluminum profile joints are included in the system boundaries.

3.2 System boundary

The model for the product’s life cycle includes the 3 steps of the “cradle to gate” approach described below according to the EN 15804 European standard:

- A1 Raw material supply: extraction and processing of raw materials, electricity production and supply, fuel production
- A2 Transport: transportation of raw materials up to the factory gate
- A3 Manufacturing: process emissions, landfilling of process wastes (non-hazardous wastes)

3.3 Estimates and assumptions

Raw material supply (A1)

Specific quantities for all raw materials have been taken into account.

Transport of raw materials (A2)

Litres of fuel	diesel: 38 l/100 km
Transport distance	specific for each raw material
Capacity utilisation (including empty runs):	70%
Capacity utilisation volume factor:	1 for all raw materials except Aluminium Hydroxide and Polyelectrolyte (factor=0,6)

Manufacturing (A3)

Process CO2, dust and water emissions have been specificaly calculated. Other impacts have been valuated from fuel consumption data.

3.4 Cut-off criteria

99% (in mass) of all inputs are covered by the present environmental impact assessment. The whole energy consumption is included into the scope of this EPD.

3.5 Background data

The main sources for background data used are Ecoinvent 2.0 and DEAM™.

3.6 Data quality

Reliability, completeness, representativity, reproducibility, and consistency of specific and background data have been checked by PwC.

The data were captured into the LCA model under TEAM™ software and validated by PwC.

3.7 Period under review

Process data have been collected from the production plant through a questionnaire completed by Eternit by PwC in 2010. The collected data is related to the 2009 production year.

3.8 Allocation

Specific data for EQUITONE TECTIVA product were used for raw materials, consumables and packaging consumption data.

Regarding energy manufacturing consumptions, an allocation per weight of product has been applied when the specific data were not available. See below the summary of allocations by process stage:

Process stage	Electrical energy	Natural gas
Preparation	Mass allocation	No consumption
Hatschek machines	Mass allocation	No consumption
Curing oven	Mass allocation	Specific measurement
Depiling	Mass allocation	No consumption
Autoclaving	Mass allocation	Specific measurement
Finishing	Specific measurement	No consumption
Water treatment	Specific measurement	No consumption

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

No additional information are necessary in a cradle-to-gate LCA.

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	Construction-installation process	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	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT: 1 m² of EQUITONE TECTIVA product

		PRODUCT STAGE		
		Raw material supply	Transport	Manufacturing
Parameter	**Unit**	**A1**	**A2**	**A3**
Global warming potential (GWP)	kg CO_2-Eq.	6,0	9,8E-01	1,1
Depletion potential of the stratospheric ozone layer (ODP)	kg CFC11-Eq.	4,9E-07	2,4E-08	4,1E-11
Acidification potential of land and water (AP)	kg SO_2-Eq.	2,1E-02	1,6E-02	2,9E-04
Eutrophication potential (EP)	g PO_4^{3-}- Eq.	2,4	2,8E-01	1,0E-01
Formation potential of tropospheric ozone photo-chemical oxidants (POCP)	kg Ethene Eq.	1,2E-03	6,0E-04	1,5E-05
Abiotic depletion potential for non fossil resources (ADPE)	kg Sb Eq.	3,1E-07	5,1E-12	8,5E-15
Abiotic depletion potential for fossil resources (ADPF)	MJ	71	12	7,2E-04

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT: 1 m² of EQUITONE TECTIVA product

		PRODUCT STAGE		
Parameter	**Unit**	**A1**	**A2**	**A3**
Use of renewable primary energy excluding renewable primary energy resources used as raw materials (PERE)	MJ	34	5,5E-03	3,6E-07
Use of renewable primary energy resources used as raw materials (PERM)	MJ	0	0	0
Total use of renewable primary energy resources (PERT)	MJ	34	5,5E-03	3,6E-07
Use of non renewable primary energy excluding non renewable primary energy resources used as raw materials (PENRE)	MJ	59	12	7,3E-04
Use of non renewable primary energy resources used as raw materials (PENRM)	MJ	31	0	0
Total use of non renewable primary energy resources (PENRT)	MJ	90	12	7,3E-04
Use of secondary material (SM)	kg	4,9E-01	0	0
Use of renewable secondary fuels (RSF)	MJ	0	0	0
Use of non renewable secondary fuels (NRSF)	MJ	0	0	0
Use of net fresh water (FW)	m³	6,5E-02	9,6E-05	1,6E-02

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT: 1 m² of EQUITONE TECTIVA product

		PRODUCT STAGE		
Parameter	**Unit**	**A1**	**A2**	**A3**
Hazardous waste disposed (HWD)	kg	1,1E-03	1,0E-05	1,7E-08
Non hazardous waste disposed (NHWD)	kg	4,4E-03	7,6E-09	2,4E-02
Radioactive waste disposed (RWD)	kg	1,9E-05	9,6E-07	1,6E-09
Components for re-use (CRU)	kg	0	0	0
Materials for recycling (MFR)	kg	0	0	0
Materials for energy recovery (MER)	kg	0	0	0
Exported energy per energy carrier (EE)	MJ	0	0	0

6 LCA: Interpretation

6.1 Global warming potential (GWP)

Methodology: CML 3.9 - Greenhouse effect (direct, 100 years)

Greenhouse gases emitted from the system boundaries are mainly due to the raw material supply stage (74%), manufacturing stage (14%), and transport of raw materials (12%). Emissions from the raw material supply stage mainly come from the cement production (64%). 97% of the emissions related to the transport of raw materials come from the fuel consumption during transport stage by boat.

6.2 Depletion potential of the stratospheric ozone layer (ODP)

No CFC gases are emitted during the life cycle of this product.

6.3 Acidification potential of land and water (AP)

Methodolgy: CML 3.9 - Air Acidification

Acidification is related to air pollutants released like sulphur and nitrogen oxides. These emissions mainly come from the raw material supply stage (54%). For this stage, cement production is responsible for 46% of the acidification impact and iron oxide is responsible for 19% of this impact. These emissions also come from the product - transport stage (45%). For this stage, fuel consumption during transport stage by boat is responsible for 99% of the acidification impact and fuel consumption during transport stage by road is responsible for 1% of this impact.

6.4 Eutrophication potential (EP)

Methodology: CML 3.9 - Eutrophication

Water eutrophication mainly comes from the raw material supply stage (86%). For this stage, cement production is responsible for 49% of the water eutrophication impact and Tasman cellulose is responsible for 12% of this impact.

6.5 Formation potential of tropospheric ozone photochemical oxidants (POCP)

Formation potential of tropospheric ozone photochemical oxidants formation mainly comes from the raw material supply stage (66%). For this stage, cement production is responsible for 37% of the photochemical ozone formation and iron oxide is responsible for 13% of this impact.

6.6 Abiotic depletion potential (ADPE and ADPF)

Methodologies: CML 3.9 - Abiotic Depletion Potential (elements) and CML 3.9 - Abiotic Depletion Potential (fossil fuels) - MJ

Natural non fossil resources depletion mainly comes from the raw material supply stage (100%). For this stage, felt is responsible for 38% of the natural non fossil resources depletion impact and cement production is responsible for 37% of this impact.

Natural fuel resources depletion mainly comes from the raw material supply stage (100%). For this stage, cement production is responsible for 27% of the natural fuel resources depletion and iron oxide is responsible for 21% of this impact.

90% of the primary energy consumed is due to the raw material supply stage. Thereof, 62% is due to aluminium hydroxide and 13% to Tasman cellulose. 10% of the primary energy consumed is due to the transport of raw materials stage. Thereof, 89% is due to the fuel consumption during transport stage by boat.

6.7 Waste

The main source of waste generation is the product - raw material supply stage (59% of all wastes).

7 Requisite evidence

7.1 Radioactivity

Radioactivity testing is not relevant for this product.

7.2 Leaching

Tectiva product has been classified as inert according to Flamish regulation (Vito report 2011/SCT/R/119)

The following tests have been performed (Elektro – Physik Aachen GmbH, 62/2007)

- leaching of solved solid particules
- leaching of solved organic carbon
- amount of mineral oil.

Concentration of flue gas in the inhalation

Sample/material no. A7102302		400 °C	
Measured value after		30 min.	60 min.
Carbon monoxide	ppm	1443	2347
Carbon dioxide	ppm	-	5000
Hydrogen cyanide	ppm	-	*
Hydrogen chloride	ppm	-	*
Nitrous vapours	ppm	-	*
Sulphur dioxide	ppm	-	
COHb (calculated from CO value)	%		>50

- = untired / * = undetectable

7.3 VOC emissions

VOC emissions have been measured for a comparable product being produced in the same production line as TECTIVA in 2006.

Calculation of the TVOC (Total Volatile Organic Ccompounds) was performed as defined by AgBB test method by addition of the results of all individual substances in the retention time interval C_6-C_{16}.

Overview of results (Eurofins Product Testing A/S, 764490D 2008):

Name	Value	Unit
TVOC (C6-C16)	<5	µg/m^3
Sum SVOC (C16-C22)	<5	µg/m^3
R	-	-
VOC without NIK	<5	µg/m^3
Carcinogenic Substances	<1	µg/m^3

8 References

Institut Bauen und Umwelt 2011

Institut Bauen und Umwelt e.V., Königswinter (pub.): Generation of Environmental Product Declarations (EPDs); General principles for the EPD range of Institut Bauen und Umwelt e.V. (IBU), 2011-06

www.bau-umwelt.de

PCR 2011, Part A

Institut Bauen und Umwelt e.V., Königswinter (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 Background Report. July 2011

www.bau-umwelt.de

PCR 2011, Part B

Institut Bauen und Umwelt e.V., Königswinter (pub.): Requirements for the EPD for fibre cement, June 2011

www.bau-umwelt.de

DIN EN ISO 14025:2011-10

Environmental labels and declarations — Type III environmental declarations — Principles and procedures

EN 15804:2012-04

Sustainability of construction works — Environmental Product Declarations — Core rules for the product category of construction products

EN 149:2001

Respiratory protective devices. Filtering half masks to protect against particles. Requirements, testing, marking

EN 12467:2004 + A1:2005 + A2:2006

Fibre cement flat sheets - Product specification and test methods

DIN EN 13501-1+A1: 2007

Fire classification of construction products and building elements. Classification using test data from reaction to fire tests

Kunnen vezelcement materialen als inerte afvalstoffen beschouwd worden?

Vito: Studie uitgevoerd in opdracht van: Eternit NV

2011/SCT/R/119

June 2011

Prüfung der toxischen Brandgase nach DIN 53436 bei 400°C

Elektro – Physik Aachen GmbH, 62/2007

OHSAS 18001:2007

Occupational Health and Safety Management System

Ecoinvent 2.0

Ecoinvent Centre, www.ecoinvent.org

TEAM™

PwC Ecobilan, http://ecobilan.pwc.fr/en/boite-a-outils/team.jhtml

Publisher
Institut Bauen und Umwelt e.V.
Rheinufer 108
53639 Königswinter
Germany

Tel. +49 (0)2223 2966 79- 0
Fax +49 (0)2223 2966 79- 0
E-mail info@bau-umwelt.com
Web **www.bau-umwelt.com**

Programme holder
Institut Bauen und Umwelt e.V.
Rheinufer 108
53639 Königswinter
Germany

Tel. +49 (0)2223 2966 79- 0
Fax +49 (0)2223 2966 79- 0
E-mail info@bau-umwelt.com
Web **www.bau-umwelt.com**

Owner of the Declaration
Eternit nv
Kuiermansstraat 1
B - 1880 Kapelle-op-den-Bos
Belgium

Tel. +32 (0)15 71 74 43
Fax: +32 (0)15 71 74 49
E-mail: info@eternit.be
Web **www.eternit.be**

Author of the Life Cycle Assessment
PwC
63, rue de Villiers
92208 Neuilly-sur-Seine cedex
France

Tel. +33 (0)1 56 57 58 59
Fax: +33 (0)1 56 57 16 36
E-mail: thierry.raes@fr.pwc.com
Web: **www.pwc.com**