ENVIRONMENTAL & HEALTH DECLARATION IN COMPLIANCE WITH FRENCH STANDARD NF P01-010

Biofib Duo Insulating Material

13 December 2010

*This declaration is presented according to the FDES (*Fiche de Déclaration Environnementale et Sanitaire *– Environmental and Health Declaration Sheet) model validated by the AIMCC (FDES – 2005 version)*

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WARNING

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CAVAC and EVEA Conseil accept no responsibility with regard to any third party to whom results of the study may have been communicated or into whose possession they may have arrived; the use of such results by said third party remains their own responsibility.

We remind you that the results of the study are based solely on the facts, circumstances and hypotheses that were submitted to us during the study. Should these facts, circumstances or hypotheses differ, the results are also liable to differ. Furthermore, the results of the study should be considered in their entirety, with reference to the hypotheses, and not in isolation.

CONTENTS

INTRODUCTION 4

INTERPRETATION GUIDE 5

1 CHARACTERISATION OF THE PRODUCT ACCORDING TO NF P01-010 §4.3 6

2 INVENTORY DATA AND OTHER DATA IN ACCORDANCE WITH NF P01-010 §5 AND COMMENTS RELATING TO THE ENVIRONMENTAL AND HEALTH-RELATED EFFECTS OF THE PRODUCT IN ACCORDANCE WITH NF P01-010 §4.7.2 7

3 REPRESENTATIVE ENVIRONMENTAL IMPACTS OF CONSTRUCTION PRODUCTS IN ACCORDANCE WITH NF P01-010 §6 16

4 CONTRIBUTION OF THE PRODUCT TO THE EVALUATION OF HEALTH RISKS AND THE QUALITY OF LIFE INSIDE BUILDINGS IN ACCORDANCE WITH NF P01-010 §7 17

5 OTHER CONTRIBUTIONS MADE BY THE PRODUCT, IN PARTICULAR WITH REGARD TO THE ECO-MANAGEMENT OF BUILDINGS, FINANCIAL ISSUES, AND COMPREHENSIVE ENVIRONMENTAL POLICY 20

6 ANNEX: CHARACTERISATION OF DATA FOR CALCULATING THE LIFE-CYCLE INVENTORY (LCI) 21

INTRODUCTION

The framework used for the presentation of the Environmental and Health Declaration for the Biofib Duo insulating material is the FDES (*Fiche de Déclaration Environnementale et Sanitaire* – Environmental and Health Declaration Sheet) template developed by the AIMCC (FDES, 2005 version).
This sheet is a suitable framework for presenting the environmental and health-related characteristics of construction products, in accordance with the requirements of French standard NF P01-010, and for providing comments and additional useful information, in line with the spirit of this standard as regards sincerity and transparency (NF P01-010 §4.2).

An accompanying report that complements the declaration has been drawn up and may be consulted, under the auspices of a confidentiality agreement, at CAVAC's head office.

Any use – in part or in full – of information supplied in this way must, as a minimum, be accompanied at all times by the complete reference of the original declaration: "full title, publication date, address of issuing body" (this issuing body should be able to supply an authentic copy).

Data producer (NF P01-010 §4)

The information contained in this declaration is provided under CAVAC's responsibility, in accordance with French standard NF P01-010 §4.6.

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INTERPRETATION GUIDE

In order to comply with French standard NF P01-010, the tables in Chapter 2 contain only values greater than 1E-6 (i.e. 0.000001). Checks have been made to ensure that the values contained in these tables contribute to the total (100%) of all environmental impacts.

The units used are specified before each flow. These units are:
- the kilogram (kg),
- the gram (g),
- the litre (L),
- the kilowatt-hour (kWh),
- the megajoule (MJ).

1 CHARACTERISATION OF THE PRODUCT ACCORDING TO NF P01-010 §4.3

1.1 Definition of the Functional Unit (FU)

A functional unit corresponds to thermal insulation of 1 m² of wall for a year on the basis of a typical lifespan of 50 years with a thermal conductivity of λ = 0.037 W/m.K, while guaranteeing the prescribed product performance.

1.2 Basic data and masses for calculating the functional unit (FU)

Quantity of product, distribution packaging, and complementary products contained in the FU on the basis of a Typical Lifespan (TL) of 50 years.

The insulating material Biofib Duo is sold in rolls 3.6 m long and 0.6 m wide, and is 100 mm thick. Its thermal resistance is 2.7 $K.m^2.W^{-1}$.

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1 m² of Biofib Duo insulating material has a density of 30 kg/m^3 and can be described as follows:

Composition	Quantity (kg)
Polyester (12%)	0.36
Flax (44%)	1.32
Hemp (44%)	1.32
Antifungal product	0.02

In order to be delivered to the worksite, the product shall be packaged using the following materials:

Product	Quantity (kg)
Pallet	0.4902
PE film	0.0767
PE cover	0.0374
Glue	0.0013

No complementary products are recommended for the deployment of the product.

The estimated scrap rate during application is 0%, owing to the dimensions of the rolls, which have been carefully chosen to minimise product wastage.

The data used in this FDES come from the insulating-material production site.

1.3 Useful technical characteristics not included in the definition of the functional unit (FU)

Commercial references concerned by this FDES are: Biofib'duo, AXTON, CALIN.

2 INVENTORY DATA AND OTHER DATA IN ACCORDANCE WITH NF P01-010 §5 AND COMMENTS RELATING TO THE ENVIRONMENTAL AND HEALTH-RELATED EFFECTS OF THE PRODUCT IN ACCORDANCE WITH NF P01-010 §4.7.2

The life-cycle inventory data presented hereafter were calculated for the functional unit defined in sections 1.1 and 1.2

An interpretation guide for the tables in this document can be found on page 5.

2.1 Consumption of natural resources (NF P01-010 §5.1)

2.1.1 Consumption of natural energy resources and energy indicators (NF P01-010 §5.1.1)

FLOW	UNITS	PRODUCTION	TRANSPORT	IMPLEMENTATION	USE PHASE	END OF LIFE	TOTAL LIFE CYCLE	
							Per year	Per typical lifespan
CONSUMPTION OF NATURAL ENERGY RESOURCES								
Wood	*kg*	1.24E-02		0.00E+00	0.00E+00		1.24E-02	6.19E-01
Coal	*kg*	9.81E-03		0.00E+00	0.00E+00	5.35E-06	9.82E-03	4.91E-01
Lignite	*kg*	1.38E-02		0.00E+00	0.00E+00	9.42E-06	1.38E-02	6.90E-01
Natural gas	*kg*	1.12E-02	5.25E-05	0.00E+00	0.00E+00	1.08E-05	1.13E-02	5.65E-01
Oil	*kg*	1.37E-02	2.29E-03	0.00E+00	0.00E+00	1.36E-04	1.62E-02	8.08E-01
Uranium (U)	*kg*			0.00E+00	0.00E+00		9.11E-07	4.56E-05
ENERGY INDICATORS								
Total primary energy	*MJ*	2.93E+00	9.95E-02	0.00E+00	0.00E+00	8.34E-03	3.04E+00	1.52E+02
Renewable energy	*MJ*	1.04E+00	2.60E-05	0.00E+00	0.00E+00	2.46E-04	1.04E+00	5.20E+01
Non-renewable energy	*MJ*	1.89E+00	9.95E-02	0.00E+00	0.00E+00	8.10E-03	2.00E+00	9.98E+01
Process energy	*MJ*	1.94E+00	9.95E-02	0.00E+00	0.00E+00	8.33E-03	2.05E+00	1.02E+02
Material energy	*MJ*	9.89E-01	0.00E+00	0.00E+00	0.00E+00	1.19E-05	9.89E-01	4.95E+01
Electricity[1]	*kWh*	1.67E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.67E-02	8.36E-01

[1]Electricity is already accounted for in the other flow categories. Only electricity used on the production site could be quantified.

COMMENTS RELATING TO THE CONSUMPTION OF NATURAL ENERGY RESOURCES AND ENERGY INDICATORS:

The insulating material Biofib Duo stands out for the proportion of renewable energy, which represents almost a third of all primary energy (32% to be exact). This is principally accounted for by material energy, as it is contained in the hemp and flax fibres (biomass energy).

However, the polyester fibre (12% of the total mass) plays an important role in energy consumption, as its manufacture represents almost 50% of non-renewable energy consumed (36% of electricity used in manufacture).

It should be noted that CAVAC has photovoltaic panels, which are used to supply electricity produced by renewable means. In accordance with NF P01-010, this electricity is not directly taken into consideration in the calculation of environmental impacts.
Currently, 4,140 m² of photovoltaic panels enable 590,000 kWh of energy to be produced per year.
The creation of three new buildings, covering a total surface area of approximately 6,240 m², is currently under way. This should enable an average of 800,000 kWh of electricity to be produced per year, which would cover more than 75% of the site's current electricity consumption.

Energy indicators must be used with precaution, as they add together energy from different sources that have different environmental impacts (ideally, one should refer to basic flows)

2.1.2 Consumption of natural non-energy resources (NF P01-010 §5.1.2)

An interpretation guide for the tables in this document can be found on page 5.

FLOW	UNITS	PRODUCTION	TRANSPORT	IMPLEMENTATION	USE PHASE	END OF LIFE	TOTAL LIFE CYCLE	
							Per year	Per typical lifespan
Antimony (Sb)	*kg*		0.00E+00	0.00E+00	0.00E+00		2.27E-14	1.14E-12
Silver (Ag)	*kg*			0.00E+00	0.00E+00		7.64E-13	3.82E-11
Clay	*kg*	1.68E-05		0.00E+00	0.00E+00		1.70E-05	8.50E-04
Arsenic (As)	*kg*	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Bauxite (Al_2O_3)	*kg*	1.13E-06		0.00E+00	0.00E+00		1.22E-06	6.11E-05
Bentonite	*kg*	5.38E-06		0.00E+00	0.00E+00		5.40E-06	2.70E-04
Bismuth (Bi)	*kg*	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Boron (B)	*kg*		0.00E+00	0.00E+00	0.00E+00		1.30E-09	6.49E-08
Cadmium (Cd)	*kg*		0.00E+00	0.00E+00	0.00E+00		1.20E-07	5.99E-06
Limestone	*kg*	1.58E-03		0.00E+00	0.00E+00		1.58E-03	7.89E-02
Sodium carbonate (Na_2CO_3)	*kg*	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Potassium chloride (KCl)	*kg*	4.45E-04	0.00E+00	0.00E+00	0.00E+00		4.45E-04	2.22E-02
Sodium chloride (NaCl)	*kg*	4.76E-05		0.00E+00	0.00E+00		4.84E-05	2.42E-03
Chromium (Cr)	*kg*	2.03E-06		0.00E+00	0.00E+00		2.03E-06	1.01E-04
Cobalt (Co)	*kg*		0.00E+00	0.00E+00	0.00E+00		1.67E-10	8.36E-09
Copper (Cu)	*kg*			0.00E+00	0.00E+00		1.40E-08	6.98E-07
Dolostone	*kg*		0.00E+00	0.00E+00	0.00E+00		2.12E-07	1.06E-05
Tin (Sn)	*kg*		0.00E+00	0.00E+00	0.00E+00		8.19E-12	4.09E-10
Feldspar	*kg*		0.00E+00	0.00E+00	0.00E+00		1.78E-13	8.92E-12
Iron (Fe)	*kg*	7.32E-05		0.00E+00	0.00E+00		7.34E-05	3.67E-03
Fluorite (CaF_2)	*kg*	3.28E-05	0.00E+00	0.00E+00	0.00E+00		3.29E-05	1.64E-03
Gravel	*kg*	2.46E-03	1.66E-06	0.00E+00	0.00E+00		2.46E-03	1.23E-01
Lithium (Li)	*kg*		0.00E+00	0.00E+00	0.00E+00		9.99E-13	4.99E-11
Kaolin ($Al_2O_3 \cdot 2SiO_2 \cdot 2H_2O$)	*kg*		0.00E+00	0.00E+00	0.00E+00		1.58E-07	7.89E-06

Magnesium (Mg)	*kg*		0.00E+00	0.00E+00	0.00E+00		2.84E-07	Code3259
Manganese (Mn)	*kg*	1.22E-06		0.00E+00	0.00E+00		1.22E-06	6.09E-05
Mercury (Hg)	*kg*		0.00E+00	0.00E+00	0.00E+00		8.64E-11	4.32E-09
Molybdenum (Mo)	*kg*		0.00E+00	0.00E+00	0.00E+00		4.46E-08	2.23E-06
Nickel (Ni)	*kg*	5.32E-06		0.00E+00	0.00E+00		5.32E-06	2.66E-04
Gold (Au)	*kg*		0.00E+00	0.00E+00	0.00E+00		8.89E-14	4.44E-12
Palladium (Pd)	*kg*		0.00E+00	0.00E+00	0.00E+00		2.57E-11	1.28E-09
Platinum (Pt)	*kg*		0.00E+00	0.00E+00	0.00E+00		7.96E-13	3.98E-11
Lead (Pb)	*kg*		0.00E+00	0.00E+00	0.00E+00		2.04E-09	1.02E-07
Rhodium (Rh)	*kg*		0.00E+00	0.00E+00	0.00E+00		7.12E-13	3.56E-11
Rutile (TiO_2)	*kg*		0.00E+00	0.00E+00	0.00E+00		9.94E-07	4.97E-05
Sand	*kg*			0.00E+00	0.00E+00		8.05E-07	4.02E-05
Silica (SiO_2)	*kg*	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sulphur (S)	*kg*		0.00E+00	0.00E+00	0.00E+00		7.46E-07	3.73E-05
Barium sulphate (BaSO4)	*kg*			0.00E+00	0.00E+00		2.03E-07	1.01E-05
Titanium (Ti)	*kg*	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tungsten (W)	*kg*	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Vanadium (V)	*kg*	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Zinc (Zn)	*kg*	4.12E-06	0.00E+00	0.00E+00	0.00E+00		4.12E-06	2.06E-04
Zirconium	*kg*		0.00E+00	0.00E+00	0.00E+00		1.19E-13	5.93E-12
Plant-based raw materials not yet specified	*kg*	5.08E-06	0.00E+00	0.00E+00	0.00E+00		5.08E-06	2.54E-04
Animal-based raw materials not yet specified	*kg*	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Intermediate products not reported (total)	*kg*	6.27E-05	0.00E+00	0.00E+00	0.00E+00		6.27E-05	3.14E-03

2.1.3 Water consumption (intake) (NF P01-010 §5.1.3)

An interpretation guide for the tables in this document can be found on page 5.

FLOW	UNITS	PRODUCTION	TRANSPORT	IMPLEMENTATION	USE PHASE	END OF LIFE	TOTAL LIFE CYCLE	
							Per year	Per typical lifespan
Water: lake	*l*	3.39E-03	0.00E+00	0.00E+00	0.00E+00		3.39E-03	1.70E-01
Water: sea	*l*	1.02E-01	0.00E+00	0.00E+00	0.00E+00	2.12E-04	1.03E-01	5.13E+00
Water: groundwater	*l*	6.55E-02	0.00E+00	0.00E+00	0.00E+00	4.68E-05	6.55E-02	3.28E+00
Water: non-specified origin	*l*	8.41E-02	9.41E-03	0.00E+00	0.00E+00	2.77E-04	9.37E-02	4.69E+00
Water: river	*l*	3.57E-01	0.00E+00	0.00E+00	0.00E+00	9.52E-04	3.58E-01	1.79E+01
Drinking water (mains supply)	*l*	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Water consumed (total)	*l*	6.12E-01	9.41E-03	0.00E+00	0.00E+00	1.49E-03	6.23E-01	3.11E+01

2.1.4 Consumption of energy and recovered materials (NF P01-010 §5.1.4)

An interpretation guide for the tables in this document can be found on page 5.

FLOW	UNITS	PRODUCTION	TRANSPORT	IMPLEMENTATION	USE PHASE	END OF LIFE	TOTAL LIFE CYCLE	
							Per year	Per typical lifespan
Recovered energy	*MJ*	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Recovered materials: total	*kg*	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Recovered materials: steel	*kg*	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Recovered materials: aluminium	*kg*	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Recovered materials: metal (non-specified)	*kg*	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Recovered materials: paper/cardboard	*kg*	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Recovered materials: plastic	*kg*	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Recovered materials: cullet	*kg*	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Recovered materials: biomass	*kg*	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Recovered materials: mineral-based	*kg*	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Recovered materials: non-specified	*kg*	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

COMMENTS RELATING TO CONSUMPTION OF ENERGY AND RECOVERED MATERIALS

As it was not possible to determine exactly what proportion of raw materials comes from the recycling circuit (in particular for polyethylene packaging materials), the worst-case assumption of 0% recycled materials was used.

2.2 Emissions in the air, water and ground (NF P01-010 §5.2)

2.2.1 Emissions in the air (NF P01-010 §5.2.1)

An interpretation guide for the tables in this document can be found on page 5.

FLOW	UNITS	PRODUCTION	TRANSPORT	IMPLEMENTATION	USE PHASE	END OF LIFE	TOTAL LIFE CYCLE	
							Per year	Per typical lifespan
Hydrocarbons (non-specified)	*g*	1.12E-02	1.41E-06	0.00E+00	0.00E+00	4.94E-05	1.12E-02	5.62E-01
Hydrocarbons (non-specified except for methane)	*g*	1.50E-02	2.60E-02	0.00E+00	0.00E+00	0.00E+00	4.10E-02	2.05E+00
PAHs[a] (non-specified)	*g*	4.75E-06		0.00E+00	0.00E+00		4.76E-06	2.38E-04
Methane (CH_4)	*g*	2.03E-01	1.02E-02	0.00E+00	0.00E+00	1.65E+00	1.86E+00	9.32E+01
Volatile organic compounds (e.g. acetone, acetate)	*g*	5.11E-02	0.00E+00	0.00E+00	0.00E+00	6.12E-04	5.17E-02	2.59E+00
Carbon dioxide (CO_2)	*g*	- 8.03E+00	7.47E+00	0.00E+00	0.00E+00	1.10E+01	1.05E+01	5.23E+02

Carbon monoxide (CO)	g	7.87E-02	1.93E-02	0.00E+00	0.00E+00	1.28E-03	9.93E-02	4.96E+00
Nitrogen oxides (NO_x as NO_2)	g	2.28E-01	8.85E-02	0.00E+00	0.00E+00	4.93E-03	3.22E-01	1.61E+01
Nitrous oxide (N_2O)	g	3.52E-02	9.62E-04	0.00E+00	0.00E+00	4.64E-05	3.62E-02	1.81E+00
Ammonia (NH_3)	g	5.25E-02		0.00E+00	0.00E+00	1.59E-05	5.25E-02	2.62E+00
Dust (non-specified)	g	6.21E-02	5.11E-03	0.00E+00	0.00E+00	4.51E-04	6.76E-02	3.38E+00
Sulphur oxide (SO_x as SO_2)	g	2.01E-01	3.22E-03	0.00E+00	0.00E+00	8.15E-04	2.05E-01	1.02E+01
Hydrogen sulphide (H_2S)	g	1.69E-04		0.00E+00	0.00E+00		1.69E-04	8.47E-03
Hydrogen cyanide (HCN)	g			0.00E+00	0.00E+00	0.00E+00	8.65E-11	4.32E-09
Organic chlorine compounds (as Cl)	g	2.49E-06	0.00E+00	0.00E+00	0.00E+00		2.49E-06	1.25E-04
Hydrochloric acid (HCl)	g	2.98E-03	0.00E+00	0.00E+00	0.00E+00	1.48E-04	3.13E-03	1.56E-01
Inorganic chlorine compounds (as Cl)	g	4.02E-05	0.00E+00	0.00E+00	0.00E+00		4.02E-05	2.01E-03
Non-specified chlorine compounds (as Cl)	g	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Organic fluorine compounds (as F)	g	3.04E-06		0.00E+00	0.00E+00		3.84E-06	1.92E-04
Inorganic fluorine compounds (as F)	g	5.89E-04		0.00E+00	0.00E+00	4.91E-05	6.39E-04	3.19E-02
Halogen compounds (non-specified)	g	6.28E-05		0.00E+00	0.00E+00		6.30E-05	3.15E-03
Cadmium and cadmium compounds (as Cd)	g	1.56E-06		0.00E+00	0.00E+00		1.77E-06	8.83E-05
Chromium and chromium compounds (as Cr)	g	3.52E-05		0.00E+00	0.00E+00		3.52E-05	1.76E-03
Cobalt and cobalt compounds (as Co)	g	4.05E-06		0.00E+00	0.00E+00		4.14E-06	2.07E-04
Copper and copper compounds (as Cu)	g	8.63E-05		0.00E+00	0.00E+00		8.67E-05	4.34E-03
Tin and tin compounds (as Sn)	g			0.00E+00	0.00E+00		2.10E-07	1.05E-05
Manganese and manganese compounds (as Mn)	g	2.14E-05		0.00E+00	0.00E+00		2.15E-05	1.08E-03
Mercury and mercury compounds (as Hg)	g	1.44E-06		0.00E+00	0.00E+00		1.47E-06	7.33E-05
Nickel and nickel compounds (as Ni)	g	8.80E-05	1.69E-06	0.00E+00	0.00E+00		8.97E-05	4.49E-03
Lead and lead compounds (as Pb)	g	1.55E-05		0.00E+00	0.00E+00		1.62E-05	8.10E-04
Selenium and selenium compounds (as Se)	g	3.93E-06		0.00E+00	0.00E+00		3.97E-06	1.99E-04
Tellurium and tellurium compounds (as Te)	g	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Zinc and zinc compounds (as Zn)	g	2.59E-04	2.88E-04	0.00E+00	0.00E+00		5.48E-04	2.74E-02
Vanadium and vanadium compounds (as V)	g	1.28E-04	6.73E-06	0.00E+00	0.00E+00		1.35E-04	6.74E-03
Silicon and silicon compounds (as Si)	g	2.69E-04		0.00E+00	0.00E+00	4.41E-06	2.73E-04	1.36E-02

Antimony and antimony compounds (as Sb)	*g*			0.00E+00	0.00E+00		3.04E-07	1.52E-05
[a] PAHs: polynuclear aromatic hydrocarbons								

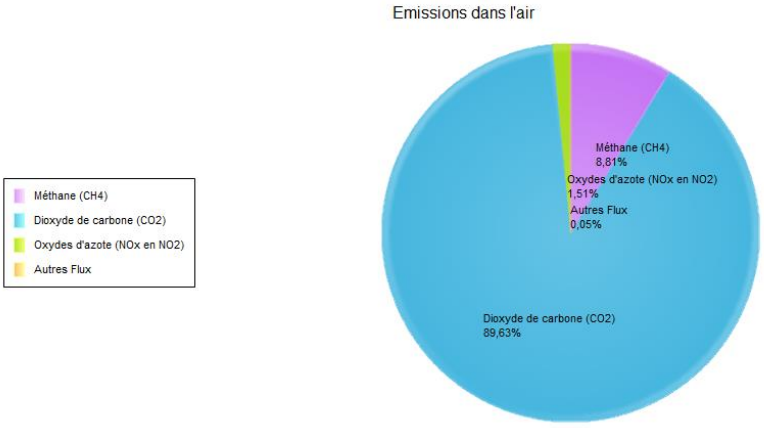
NOTE: This table must be updated to include details of radioactive emissions as soon as the European Euratom directive on radioactive emissions is published.

COMMENTS ON EMISSIONS IN THE AIR:

Emissions in the air principally consist of greenhouse gases, in particular carbon dioxide (90%) and methane (9%). These emissions mainly take place at the end of the product's lifetime, when organic materials are broken down by microorganisms.

Emissions during the production phase are mostly the result of the spreading of NPK fertilisers.

This provision of nutrients is, as far as possible, ensured by organic fertilisers; however, organic fertilisers alone cannot meet all the plant's needs, owing to the nitrogen–phosphorus–potassium balance involved.



Methane (CH_4)	Methane (CH_4) 8.81%
Carbon dioxide (CO_2)	Nitrogen oxides (NO_x as NO_2) 1.51%
Nitrogen oxides (NO_x as NO_2)	Other flows 0.05%
Other flows	Carbon dioxide (CO_2) 89.63%

2.2.2 *Emissions in water (NF P01-010 §5.2.2)*

An interpretation guide for the tables in this document can be found on page 5.

FLOW	UNITS	PRODUCTION	TRANSPORT	IMPLEMENTATION	USE PHASE	END OF LIFE	TOTAL LIFE CYCLE	
							Per year	Per typical lifespan
COD (chemical oxygen demand)	*g*	1.22E-01	3.38E-04	0.00E+00	0.00E+00	6.50E+00	6.62E+00	3.31E+02
BOD_5 (five-day biochemical oxygen demand)	*g*	1.04E-01	1.02E-05	0.00E+00	0.00E+00	1.54E+00	1.64E+00	8.21E+01
Suspended matter (SM)	*g*	7.20E-03	5.36E-05	0.00E+00	0.00E+00	1.19E-05	7.26E-03	3.63E-01
Cyanide (CN-)	*g*	1.47E-06		0.00E+00	0.00E+00		1.95E-06	9.77E-05

Adsorbable organic halides (AOX)	*g*	1.38E-06	0.00E+00	0.00E+00	0.00E+00		1.39E-06	6.94E-05
Hydrocarbons (non-specified)	*g*	3.39E-02	3.48E-03	0.00E+00	0.00E+00	5.12E-04	3.79E-02	1.90E+00
Nitrogen compounds (as N)	*g*	1.55E-01	3.17E-04	0.00E+00	0.00E+00	7.48E-02	2.30E-01	1.15E+01
Phosphorus compounds (as P)	*g*	4.91E-02		0.00E+00	0.00E+00	1.53E-04	4.92E-02	2.46E+00
Organic fluorine compounds (as F)	*g*	1.36E-06	2.37E-06	0.00E+00	0.00E+00	0.00E+00	3.73E-06	1.86E-04
Inorganic fluorine compounds (as F)	*g*		0.00E+00	0.00E+00	0.00E+00		1.79E-08	8.94E-07
Non-specified fluorine compounds (as F)	*g*	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Organic chlorine compounds (as Cl)	*g*	3.51E-06		0.00E+00	0.00E+00		3.52E-06	1.76E-04
Non-specified chlorine compounds (as Cl)	*g*	1.14E-06	1.98E-06	0.00E+00	0.00E+00	0.00E+00	3.12E-06	1.56E-04
PAHs (non-specified)	*g*	2.23E-06		0.00E+00	0.00E+00		2.29E-06	1.15E-04
Metals (non-specified)	*g*	8.57E-02	7.36E-02	0.00E+00	0.00E+00	5.92E-03	1.65E-01	8.26E+00
Alkali metals and alkaline earth metals	*g*	2.01E+00	0.00E+00	0.00E+00	0.00E+00	1.95E-01	2.20E+00	1.10E+02
Aluminium and aluminium compounds (as Al)	*g*			0.00E+00	0.00E+00	0.00E+00	1.43E-06	7.13E-05
Arsenic and arsenic compounds (as As)	*g*			0.00E+00	0.00E+00	0.00E+00	1.49E-07	7.46E-06
Cadmium and cadmium compounds (as Cd)	*g*			0.00E+00	0.00E+00	0.00E+00	2.49E-07	1.25E-05
Chromium and chromium compounds (as Cr)	*g*	5.91E-06		0.00E+00	0.00E+00		6.48E-06	3.24E-04
Hexavalent chromium (chromates, etc.)	*g*	3.25E-04	0.00E+00	0.00E+00	0.00E+00	1.27E-05	3.38E-04	1.69E-02
Copper and copper compounds (as Cu)	*g*			0.00E+00	0.00E+00	0.00E+00	5.04E-07	2.52E-05
Tin and tin compounds (as Sn)	*g*		0.00E+00	0.00E+00	0.00E+00		7.84E-07	3.92E-05
Iron and iron compounds (as Fe)	*g*	1.60E-05	2.78E-05	0.00E+00	0.00E+00	0.00E+00	4.38E-05	2.19E-03
Mercury and mercury compounds (as Hg)	*g*	1.09E-05		0.00E+00	0.00E+00	2.79E-05	3.88E-05	1.94E-03
Nickel and nickel compounds (as Ni)	*g*			0.00E+00	0.00E+00	0.00E+00	8.60E-07	4.30E-05
Lead and lead compounds (as Pb)	*g*	1.29E-04		0.00E+00	0.00E+00	5.32E-03	5.44E-03	2.72E-01
Zinc and zinc compounds (as Zn)	*g*			0.00E+00	0.00E+00	0.00E+00	1.50E-06	7.50E-05
Rejected water	*g*	2.23E-04	3.87E-04	0.00E+00	0.00E+00	0.00E+00	6.10E-04	3.05E-02

2.2.3 *Emissions in the ground (NF P01-010 §5.2.3)*

An interpretation guide for the tables in this document can be found on page 5.

FLOW	UNITS	PRODUCTION	TRANSPORT	IMPLEMENTATION	USE PHASE	END OF LIFE	TOTAL LIFE CYCLE	
							Per year	Per typical lifespan
Arsenic and arsenic compounds (as As)	g			0.00E+00	0.00E+00		1.37E-08	6.83E-07
Biocides[b]	g	9.24E-05	0.00E+00	0.00E+00	0.00E+00		9.24E-05	4.62E-03
Cadmium and cadmium compounds (as Cd)	g			0.00E+00	0.00E+00		6.99E-08	3.49E-06
Chromium and chromium compounds (as Cr)	g			0.00E+00	0.00E+00		4.29E-07	2.15E-05
Hexavalent chromium (chromates, etc.)	g		0.00E+00	0.00E+00	0.00E+00		4.78E-10	2.39E-08
Copper and copper compounds (as Cu)	g			0.00E+00	0.00E+00		4.16E-07	2.08E-05
Tin and tin compounds (as Sn)	g		0.00E+00	0.00E+00	0.00E+00		8.63E-10	4.31E-08
Iron and iron compounds (as Fe)	g	1.08E-03	1.76E-06	0.00E+00	0.00E+00	1.25E-06	1.09E-03	5.43E-02
Lead and lead compounds (as Pb)	g			0.00E+00	0.00E+00		3.58E-07	1.79E-05
Mercury and mercury compounds (as Hg)	g			0.00E+00	0.00E+00		8.97E-10	4.49E-08
Nickel and nickel compounds (as Ni)	g			0.00E+00	0.00E+00		1.24E-07	6.22E-06
Zinc and zinc compounds (as Zn)	g	1.03E-04		0.00E+00	0.00E+00		1.04E-04	5.18E-03
Heavy metals (non-specified)	g	4.17E-05	0.00E+00	0.00E+00	0.00E+00		4.17E-05	2.09E-03
Alkali metals and alkaline earth metals	g	7.23E-04	0.00E+00	0.00E+00	0.00E+00		7.23E-04	3.62E-02

[b] Biocides: for example, pesticides, herbicides, fungicides, insecticides, bactericides.

2.3 Production of waste (NF P01-010 §5.3)

2.3.1 *Recycled waste (NF P01-010 §5.3)*

An interpretation guide for the tables in this document can be found on page 5.

FLOW	UNITS	PRODUCTION	TRANSPORT	IMPLEMENTATION	USE PHASE	END OF LIFE	TOTAL LIFE CYCLE	
							Per year	Per typical lifespan
Recovered energy	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Recovered materials: total	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Recovered materials: steel	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Recovered materials: aluminium	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Recovered materials: metal (non-specified)	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Recovered materials: paper/cardboard	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Recovered materials: plastic	*kg*	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Recovered materials: cullet	*kg*	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Recovered materials: biomass	*kg*	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Recovered materials: mineral-based	*kg*	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Recovered materials: non-specified	*kg*	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

2.3.2 Eliminated waste (NF P 01-010 §5.3)

An interpretation guide for the tables in this document can be found on page 5.

FLOW	UNITS	PRODUCTION	TRANSPORT	IMPLEMENTATION	USE PHASE	END OF LIFE	TOTAL LIFE CYCLE	
							Per year	Per typical lifespan
Hazardous waste	*kg*	3.26E-05	2.25E-06	0.00E+00	0.00E+00	7.65E-04	8.00E-04	4.00E-02
Non-hazardous waste	*kg*	1.87E-03		0.00E+00	0.00E+00	9.46E-06	1.88E-03	9.38E-02
Inert waste	*kg*	1.26E-02	3.90E-06	0.00E+00	0.00E+00	5.80E-02	7.06E-02	3.53E+00
Radioactive waste	*kg*	7.84E-06	1.60E-06	0.00E+00	0.00E+00		9.46E-06	4.73E-04

COMMENTS REGARDING WASTE:

It was not possible to determine with certainty whether product packaging contained a proportion of recycled material; therefore, the least favourable scenario was taken into consideration for the analysis (i.e. 0% recycled materials).

3 REPRESENTATIVE ENVIRONMENTAL IMPACTS OF CONSTRUCTION PRODUCTS IN ACCORDANCE WITH NF P01-010 §6

All these impacts are given or calculated in accordance with the indications in §6.1 of French standard NF P01-010, based on the data presented in §2 above for the reference functional unit (per year) defined in §1.1 and §1.2 of this declaration, as well as for the functional unit for the entire typical lifespan (TL).

N°	ENVIRONMENTAL IMPACT	INDICATOR VALUE FOR THE FUNCTIONAL UNIT (FU)	INDICATOR VALUE FOR TYPICAL LIFESPAN
1	**CONSUMPTION OF ENERGY RESOURCES**		
	Total primary energy	3.04E+00 MJ/UF	1.52E+02 MJ
	Renewable energy	1.04E+00 MJ/UF	5.20E+01 MJ
	Non-renewable energy	2.00E+00 MJ/UF	9.98E+01 MJ
2	**RESOURCE DEPLETION (ADP)**	7.61E-04 kg équivalent antimoine (Sb)/UF	3.80E-02 kg équivalent antimoine (Sb)
3	**TOTAL WATER CONSUMPTION**	6.23E-01 litre/UF	3.11E+01 litre
4	**SOLID WASTE**		
	Recycled waste (total)	0.00E+00	0.00E+00
	Eliminated waste:		
	Hazardous waste	8.00E-04 kg/UF	4.00E-02 kg
	Non-hazardous waste	1.88E-03 kg/UF	9.38E-02 kg
	Inert waste	7.06E-02 kg/UF	3.53E+00 kg
	Radioactive waste	9.46E-06 kg/UF	4.73E-04 kg
5	**CLIMATE CHANGE**	6.10E-02 kg équivalent CO2/UF	3.05E+00 kg équivalent CO2
6	**ATMOSPHERIC ACIDIFICATION**	5.32E-04 kg équivalent SO2/UF	2.66E-02 kg équivalent SO2
7	**AIR POLLUTION**	6.85E+00 m^3/UF	3.43E+02 m^3
8	**WATER POLLUTION**	3.06E-01 m^3/UF	1.53E+01 m^3
9	**DESTRUCTION OF THE STRATOSPHERIC OZONE LAYER**	1.00E-10 kg CFC équivalent R11/UF	5.02E-09 kg CFC équivalent R11
10	**PHOTOCHEMICAL OZONE FORMATION**	2.60E-05 kg équivalent éthylène/UF	1.30E-03 kg équivalent éthylène
OTHER INDICATORS (NOT IN STANDARD NF P01-010)			
11	**EUTROPHICATION**	6.19E-04 kg équivalent PO_4^{3-}/UF	3.09E-02 kg équivalent PO_4^{3-}

4 CONTRIBUTION OF THE PRODUCT TO THE EVALUATION OF HEALTH RISKS AND THE QUALITY OF LIFE INSIDE BUILDINGS IN ACCORDANCE WITH NF P01-010 §7

CONTRIBUTION OF PRODUCT		PARAGRAPH CONCERNED	EXPRESSION (MEASUREMENTS, CALCULATIONS, ETC.)
Evaluation of health risks	Health-related quality of indoor spaces	§4.1.1	No TVOC emissions; Surface fungicide; No development of clothes moths or termites.
	Health-related quality of water	§4.1.2	Not concerned
Quality of life	Hygrothermal comfort	§4.2.1	μ = 2 □ = 0.041 W/m.K Phase shift: 2.25 h
	Acoustic comfort	§4.2.2	Reduction of 43 dB
	Visual comfort	§4.2.3	Not concerned
	Olfactory comfort	§4.2.4	Not concerned

4.1 Useful information for the evaluation of health risks (NF P01-010 §7.2)

4.1.1 Contribution to the health-related quality of indoor spaces (NF P01-010 §7.2.1)

No allergenic elements were emitted into the indoor air by the hemp–flax insulating material, simply because the binder used is made of polyester. This also means that there are no volatile organic compound (VOC) emissions involved in the implementation either of the product or during its lifetime, according to the report N ° 2011-02-070.

The only additional product that must be used is a fungicide, in order to reinforce the natural protection of the hemp and flax fibres and thus meet the requirements of the classification standard for anti-mildew products:

Antifungal product	Classification	Quantity per year (kg)	Quantity per typical lifespan (kg)
2-Octyl-2H-isothiazol-3-one	Xn, N	4E-4	2E-2

In parallel, hemp is known as an effective repellent against insects and small pests (e.g. rodents). To confirm this, the following tests were carried out:

- Test concerning the insulating material's ability to resist fungal contamination: carried out in accordance with standards NF EN ISO 846 and NF V 18-112 by the CSTB, and reported in the test report entitled "ESE Santé 2010-024".

  Following these tests, the product can be considered as a surface fungicide. Nevertheless, one should, as far as possible, avoid subjecting the product to a relative humidity of more than 70%.

- Test concerning the development of clothes moths and termites: in accordance with Annex D of the Common Understanding of Assessment Procedure (CUAP) standard.

Here, the conclusions are clear: no such development occurred on the proposed hemp–flax insulating material.

- Fibres rejected into the air: No measurements are currently available.
- Exposure during the lifetime of the product and on the worksite: No measurements are currently available.
- Measurement of the product's radioactive emissions: No measurements are currently available.

4.1.2 Contribution to the health-related quality of water (NF P01-010 §7.2.2)

The hemp–flax insulating material is not concerned by this aspect: at no point in its life cycle does it come into contact with water.

4.2 Useful information for the evaluation of health risks (NF P01-010 §7.2)

4.2.1 Product characteristics that contribute to ensuring hygrothermal comfort in the building (NF P01-010 §7.3.1)

Comfort within a building depends on both the thermal performance and the hygrometric performance of the products used in its construction.

- The cellular structure of plant fibres such as hemp and flax enable them to regulate humidity within a building more effectively. In other words, these fibres have the ability to absorb part of the ambient humidity and restore this humidity when the air is drier.

  This is described as the degree of openness to diffusion, expressed by μ, the vapour resistance coefficient (μ = 2).
  Accordingly, the hygrometric balance will protect the most sensitive materials, such as wood and plaster, and will create good breathable walls – a concept that is applicable to wood-frame houses in particular.

- Thermal insulation is most often qualified by thermal resistance (R). However, this criterion depends not just on the thickness of the insulating material chosen, but also the specific thermal conductivity coefficient of each material.
  The "hollow" structure of the hemp and flax fibres ensures a high level of thermal efficiency. The coefficient λ is 0.037 W/m.K.

These properties can be summarised as follows:

Density	**30 kg/m³**
Thermal conductivity (λ)	**0.041** W/m.K (NF 10.021)
Thermal resistance (in m²K/W)	**2.44** for a thickness of 100 mm **4.88** for a thickness of 200 mm

- A third key parameter is the level of summertime comfort provided and the notion of "phase shift". This slows down the progression of heat and slows down dissipation. In this regard, the hemp–flax insulating material has a high level of thermal inertia, the values of which are given below (expressed in terms of hours of phase shift):

Phase shift (in hours)	Biofib Duo panel (30 kg/m³)
Thickness of 100 mm	2.25
Thickness of 140 mm	4.06
Thickness of 200 mm	5.5

These performances are guaranteed over time by the mechanical resistance of the rolls. The spring effect of the material guards against weakening or collapse.

Hemp is one of the most resistant natural fibres, while flax fibres – more flexible and elastic – ensure the insulating mattress is resilient. Finally, to avoid thermal bridges, panels made of this product must be installed in a slightly compressed state against the uprights.

4.2.2 Product characteristics that contribute to ensuring acoustic comfort in the building (NF P01-010 §7.3.2)

Sound insulation is characterised by the sound reduction index, expressed in decibels (dB), and which corresponds to the difference in intensity between a normalised sound emitted from one side of the wall to be tested and the sound level detected on the other side of the wall.

Measurements for this hemp–flax insulating material show a sound reduction of 43 dB according to report no.2009-460 of 5 November 2009.

4.2.3 Product characteristics that contribute to ensuring visual comfort in the building (NF P01-010 §7.3.3)

Not concerned. Under normal usage conditions, the product is no longer visible – from the inside or the outside – once it has been installed.

4.2.4 Product characteristics that contribute to ensuring olfactory comfort in the building (NF P01-010 §7.3.4)

Not concerned.

5 OTHER CONTRIBUTIONS MADE BY THE PRODUCT, IN PARTICULAR WITH REGARD TO THE ECO-MANAGEMENT OF BUILDINGS, FINANCIAL ISSUES, AND COMPREHENSIVE ENVIRONMENTAL POLICY

5.1 Eco-management of buildings

5.1.1 Energy management

The hemp–flax insulating material contributes to the building's thermal insulation, and consequently helps to manage the energy inputs that occur as effectively as possible.

5.1.2 Water management

Not concerned.

5.1.3 Upkeep and maintenance

No maintenance is necessary throughout the designated typical lifespan (50 years).

5.2 Financial issues

By enabling better management of energy inputs in the building, the hemp–flax insulating material enables the user to reduce the amount of heating necessary, and therefore make financial savings.

5.3 Comprehensive environmental policy

5.3.1 Natural resources

The hemp and flax resources used by CAVAC are locally sourced (within a 50 km radius) and are grown on parcels of land where the following environmentally responsible agricultural practices are implemented:

- minimum irrigation; or
- maximum use of organic fertilisers (which are very well assimilated by hemp, in particular); or
- minimum crop-protection treatment (only between two crops for hemp).

5.3.2 Emissions in the air and in water

The product's emissions in the air and in water are limited to leaching of nitrogen, phosphorus and potassium fertilisers, as is the case for any crop that uses such fertilisers.

Emissions have also been measured on the production site, with a measured dust value that is below the regulatory limit.

5.3.3 Waste

Hemp straw and flax straw are delivered in the form of bales (tied with baler twine), which generates only a very small amount of waste. Similarly, all other waste comes exclusively from packaging materials, binders (bundles under plastic sheets) and glue, representing little in the way of volume on the worksite. Furthermore, given the recent start-up of the production site, the recycling circuits are not yet fully operational, but they will be in the

coming months, in conjunction with the project (under way) regarding cooperation for the management, recycling and reuse of waste (resulting from our business activities and those of associate farmers).

6 ANNEX: CHARACTERISATION OF DATA FOR CALCULATING THE LIFE-CYCLE INVENTORY (LCI)

This annexe is taken from the accompanying report that complements this declaration (see Introduction).

6.1 Definition of the life-cycle analysis (LCA) system

6.1.1 Stages and flows included

PRODUCTION

- Hemp cultivation [1]
- Flax cultivation [1]
- Polyester fibres [1]
- Fungicide [1]
- Production data for the insulating material: separation of fibres, assembling of materials [1]

TRANSPORT

- From the production site to the worksite [2]

IMPLEMENTATION

- Data supplied by CAVAC [3]

UTILISATION

- No data to be taken into consideration

END OF LIFE

- Burial at the end of the product's lifetime has been taken into account [4]

6.1.2 Omitted flows

French standard NF P01-010 allows the following flows to be omitted from the system perimeter:

- lighting, heating and cleaning of workshops;
- the administration department;
- the transport of employees;
- the manufacture of the production facilities and the transport systems (machines, lorries, etc.).

6.1.3 Rules for the definition of perimeters

French standard NF P01-010 sets the cut-off threshold at 98%, in accordance with paragraph 4.5.1 of the standard.

In the context of this declaration, the percentage of reported flows is 99.97%.

The flows not taken into account in the results tables are as follows:

- the glue required for the packaging of the end product (1.3 g, or 0.03% of the mass of the product);
- the packaging of crop-protection products (less than 0.0001% of the mass of the product).

6.2 Data sources

6.2.1 *Characterisation of main data*

[1] MANUFACTURE
Year: 2009/10 financial year
Geographical representativeness: France
Technological representativeness: 2009/10 financial year
Source: CAVAC

[2] TRANSPORT
Year: 2009/10 financial year
Geographical representativeness: France
Technological representativeness: 2009/10 financial year
Source: CAVAC

[3] IMPLEMENTATION
Year: 2009/10 financial year
Geographical area: France
Source: CAVAC

[4] END OF LIFE
Year: 2009/10 financial year
Geographical area: France
Source: CAVAC

6.2.2 *Energy data*

The data used are taken from the AFNOR document FD P01-015, as well as the EcoInvent database (v. 2.2).

6.2.3 *Non-LCI data*

These data were supplied by CAVAC.

6.3 Traceability

This FDES was produced using:

- the life-cycle analysis software SimaPro (v. 7.2.4);
- the Ev-DEC (www.ev-dec.com) application, developed by the consultancy firm EVEA Conseil (www.evea-conseil.com), which assisted the production of FDESs.