





Environmental Product Declaration

In accordance with EN 15804+A2 and ISO 14025

[Collective EPD: Loose fill cellulose insulation]



1. GENERAL INFORMATION

Product name:	Loose fill cellulose insulation <ul style="list-style-type: none"> • Open blowing for attics, • Blown into pitched roofs, • Blown into walls.
Date of Issue:	December 2023
Date of verification:	11 December 2023
Validity:	5 years
Product unit:	1 kg or 1 m ² , depending on the application
Owner of the declaration	European Cellulose Insulation Association (ECIA) Dreve du Pressoir 38 1190 Forest Brussels, Belgium www.ecia.eu.com 
Conductor of the LCA	WeLOOP 254 rue du Bourg, 59130 Lambersart, France https://www.weloop.org/fr/ 
Verification:	Independent verification by external third-party verifier Dr Frank Werner
Type of EPD	Collective Cradle-to-grave with module D

Accountabilities for PCR, LCA and independent, third-party verification
Product Category Rules (PCR)
CEN standard EN 15804 serves as the Core Product Category Rules (PCR)
Product Category Rules (PCR): <i>Construction products, PCR 2019:14, version 1.2.5 ; Thermal insulation products (EN 16783:2017), C-PCR-005 (TO PCR 2019:14), version 2019-12-20 ; Thermal insulation products — Environmental Product declarations (EPD) — Product Category Rules (PCR) complementary to EN 15804 for factory made and in-situ formed products, prEN 16783:2022</i>
Life Cycle Assessment (LCA)
LCA accountability: Dr. Carolina Szablewski, Dr. Naeem Adibi, Sam Herlicq WeLOOP
Third-party verification
Independent third-party verification of the declaration and data, according to ISO 14025:2006, via:
<input checked="" type="checkbox"/> EPD verification by individual verifier
Third-party verifier: Dr. Frank Werner

1.1 PRODUCT DESCRIPTION

The loose fill cellulose insulation products are made from recovered papers (including different recovered products from the paper industry like newsprint, papers, cardboard and fibre-based packaging) with mineral inorganic flame retardant additives. This insulation material is used for thermal and acoustic insulation of buildings. It is used to insulate walls, roofs, attics and mezzanine floors. Loose fill cellulose insulation products may be reused or recycled at the end-of-life. Products are recovered using a reverse installation process.

1.2 GOAL AND SCOPE

This study aims to gather data regarding the environmental impacts of loose fill cellulose insulation products during their lifespan, improving the understanding of the environmental impact over the complete lifecycle. The results can be used to eco-design the product.

Furthermore, the results can be used to inform potential customers about the environmental impact of loose fill cellulose insulation products in all European countries.

1.3 GEOGRAPHICAL SCOPE

The cellulose insulation materials that are assessed in the LCA study are coming from 15 production sites in Europe (Austria (2), Belgium (2), Czech Republic, Finland (2), France (2), Germany (2), Spain, Sweden (2) and Switzerland) as illustrated in Figure 1.

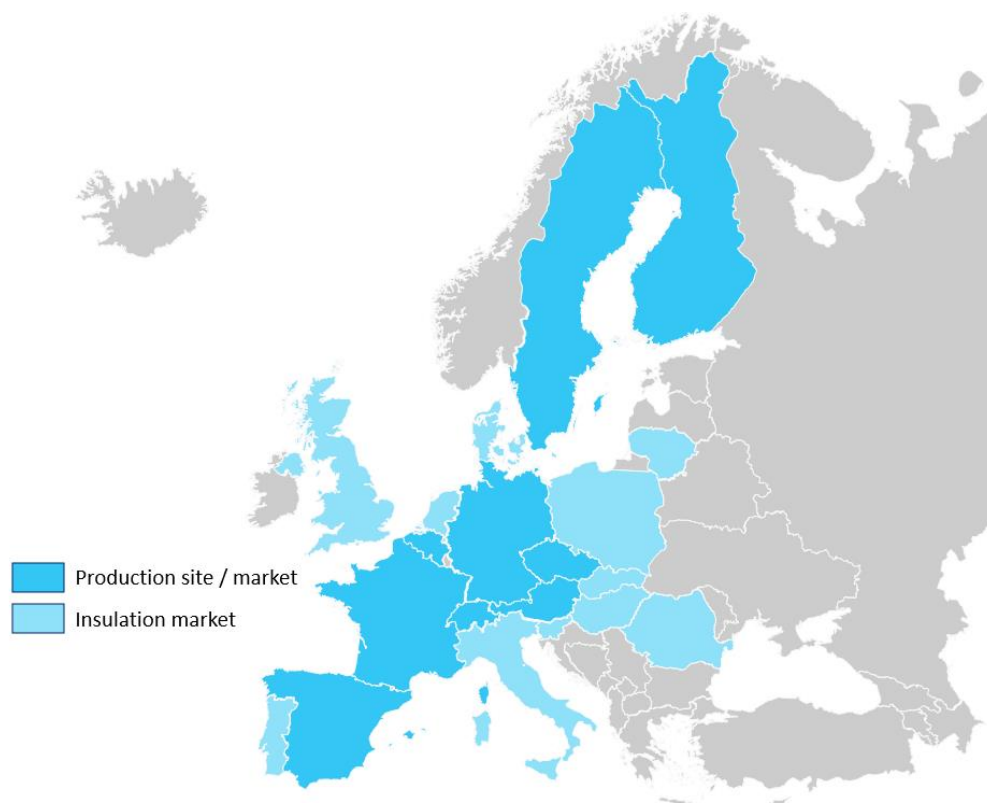


Figure 1: Production sites and markets covered by this EPD

1.4 PARTICIPATING COMPANIES

- Aislanat - AISLANAT S.L., Spain (including **Aislanat aislante de celulosa** products),
- CIUR – CIUR a.s., Czech Republic (including **Climatizer Plus** product),
- Climacell - CWA Cellulose Werk, Germany (Including **Climacell "s"**, **Climacell Loft** and **Climacell green nature** products),
- Ekovilla - Kiiminki, Kuusankoski and Ylistaro, Finland (including **Ekovilla**, **Ekovilla IA**, **Ekovilla Puru**, **Isonem**, **Isolet**, **Nviro GreenWool**, **Ekovillalevy**, **Ekovilla Slab** and **Ekovilla Skivan** products),
- Igloo - Igloo France Cellulose (including **Cellulose**, **IGLOO France**, **Ouatipi**, **WattLess**, **Grey Snow**, **CELLULO'PRO** products),
- Isocell - CPB AG Belgium, CPH Austria, Dämmstatt GmbH Germany, SCP AB Sweden (including **Zellulosedämmstoff**, **Daemmstatt D**, **Klima-Tec-Flock**, **Isocell D**, **Isocell for you** and **Cellulose insulation** products),
- Isofloc – isofloc AG, Switzerland (including **isofloc LM** products),
- ISOPROC – ISOPROC, Belgium (including **ISOPROC loose fill insulation** product),
- Ouattitude – Ouattitude, France (including **Ouattitude**, **Cloudy Cellulose**, **IGLOO France S** and **Isocell F** products),
- Termex - Termex-Saarijärvi, Finland (including **Termex-Selluvilla** products),
- Warmfiber - Warmfiber Isolering AB, Sweden (including **Warmfiber** products),
- Wolfinger – Wolfinger GmbH, Austria (including **Wolfinger Zellulosedämmung** products).

1.5 REPRESENTATIVENESS OF THE PRODUCTION PROCESS

This product is made following the companies' production protocols and national standards. The total output of the 15 studied production sites represents the main part of cellulose insulation material sold in Europe.

2. FUNCTIONAL UNIT DESCRIPTION AND PRODUCT INFORMATION

2.1 DECLARED UNIT

The declared unit is 1 kg of cellulose loose fill insulation. The average density¹ of the product in this EPD is 41 kg/m³. The declared unit is used instead of the functional unit when the precise function of the product is not defined or not covered among the functional units included in this report.

2.2 FUNCTIONAL UNITS

2.2.1 Functional Unit for Open-Blowing Attics Applications

Cellulose insulation is installed in open attics using a dry blowing process without adding glue or water, as shown in Figure 2. The functional unit in open attics is defined as:

"The thermal insulation of 1m² of attic (open blowing application), with a cellulose loose fill insulation (installed density of 32.0 kg/m³) thickness (266 mm) that gives an overall thermal resistance of 7 (m²·K/W) (R-value), with a designed lifespan of 50 years".



Figure 2: Cellulose insulation in open attics

¹ Average density is obtained based on weighted average (based on sale volumes) of the declared density provided by the participating companies.

Product description	Average	Units
Lowest installed density	27.3	kg/m ³
Highest installed density	34.2	kg/m ³
Average installed density¹	32.0	kg/m ³
Lambda value (λ)	0.038	W/(m·K)
The duration/lifespan of the product	50	Years

Table 1: Characteristics of cellulose insulation in open attic applications

For open-blowing applications, the settlement of the blown layer is considered in the installed product's density.

2.2.2 Functional Unit for Pitched Roof Applications

The cellulose insulation is installed in a pitched roof by blowing dry cellulose into the roof cavity (compartment) without adding glue or water, as shown in Figure 3. The functional unit of the pitched roof application is defined as:

"The thermal insulation of 1m² of pitched roof, with a cellulose loose fill insulation (installed density of 49.0 kg/m³) thickness (266 mm) that gives an overall thermal resistance of 7 (m²·K/W) (R-value), with a designed lifespan of 50 years".



Figure 3: Cellulose insulation in a pitched roof

Product description	Average	Units
Lowest installed density	43.9	kg/m ³
Highest installed density	52.0	kg/m ³
Average installed density²	49.0	kg/m ³
Lambda value (λ)	0.038	W/(m·K)
The duration/lifespan of the product	50	Years

Table 2: Characteristics of cellulose insulation in pitched roof applications

2.2.3 Functional Unit for Wall Applications

The cellulose insulation is installed in walls by blowing dry cellulose into the closed wall cavity (compartment), as shown in Figure 4. The functional unit of the wall applications is defined as:

² Average density is obtained based on weighted average (based on sale volumes) of the declared density provided by the participating companies.

"The thermal insulation of 1m² of wall, with a cellulose loose fill insulation (installed density of 50.7 kg/m³) thickness (133 mm) that gives an overall thermal resistance of 3.5 (m²·K)/W (R-value), with a designed lifespan of 50 years".

Product description	Average	Units
Lowest installed density	46.5	kg/m ³
Highest installed density	56.9	kg/m ³
Average gross installed density ²	50.7	kg/m ³
Lambda value (λ)	0.038	W/(m.K)
The duration/life span of the product	50	Years

Table 3: Characteristics of cellulose insulation in wall applications



Figure 4: Cellulose insulation in a wall

2.3 COMPOSITION AND CONTENT

The main components of the product are provided in Table 4.

Material input	%
Recovered paper	85-95
Inorganic flame retardants	5-15

Table 4: Composition of cellulose insulation product

The information on the lifespan of loose fill cellulose insulation products is provided by ECIA. If installed correctly according to the manufacturers' guidelines, loose fill cellulose insulation products need no further maintenance, repair, replacement or refurbishment during the full life span of the product. If the product is applied and maintained following the installation and maintenance instructions, the life span of 50 years is applicable based on the durability and the construction products directive from the European Commission.

The loose fill cellulose insulation contains boric acid – SVHC substance registered at ECHA – in a concentration above 0.1% of final product mass, as a fire retardant.

3. LCA STUDY

3.1 SOFTWARE

When calculating the environmental impact categories, SimaPro version 9.5.0.0 (July 2023) was used, as well as environmental data from the Ecoinvent database, version 3.9, released in November 2021.

3.2 INFORMATION ON ALLOCATION

No co-product allocation occurs in the product foreground system. No multi-input allocation occurs in the product system. The allocations from the background database are kept intact.

3.3 INFORMATION ON CUT-OFF

The companies reported data, and some plausibility and completeness assessments and checks were conducted for some inputs. For a few remaining data, no extended assessment was conducted, therefore accepting data gaps. In all cases, it is assumed that the cut-off criteria of EN 15804+A2 are met.

3.4 INFORMATION ON EXCLUDED PROCESSES

The following processes were excluded from the inventory:

- The effects of capital goods and infrastructural processes.
- Flows related to human activities such as employee transport and administration activity.

3.5 INFORMATION ON BIOGENIC CARBON MODELLING

Loose fill cellulose insulation products are mainly made from recovered sorted papers with high biogenic carbon content. As long as the product is in use, this carbon is stored in the product. For loose fill cellulose insulation products, the amount is assessed based on the following formula and is provided in the overall LCA results:

$\text{CO}_2 \text{ content kg in air} = (\text{paper content}) / 1.1 \text{ (factor } 10\% > 0\% \text{ moisture content)} \times 0,444 \text{ (IPCC, 2006) (carbon content)} \times 3,67 \text{ (mol ratio CO}_2 - \text{C)};$ presented in kg CO₂ / kg cellulose materials.

3.6 ADDITIONAL OR DEVIATING CHARACTERISATION FACTORS

The impact assessment method used in this study is the EN 15804 + A2 (Simapro software) using the EF3.1 indicators from the European Commission adjusted according to the requirement of EN 15804+A2.

3.7 VARIABILITY CHECK

For this EPD, the average results over modules A1-A3 were compared to variations of individual company results for three indicators: Climate Change – Total, Climate Change - Biogenic and Total Use of Non-Renewable Primary Energy Resources (PENRT). Variations are mainly due to the differences in proportions of virgin materials (paper versus additives). The difference in electricity mix between the different producers is also responsible for variations in PENRT. Average and individual results obtained are presented, and variations are documented in the confidential background report.

3.8 INFORMATION ON MOST INFLUENCING PARAMETERS IN THE LCA

- Composition of products (share of recycled paper content in the product),
- Composition of additives,
- Energy consumption and energy source in the manufacturing plant,
- Density of product (specific for applications) and lambda value,
- Transport density and distance (compression rate of product),
- End-of-life scenario.

3.9 DESCRIPTION OF THE MAIN DIFFERENCES BETWEEN THE PRODUCTS COVERED BY THIS EPD

- Similar composition and manufacturing processes,
- Different energy mix for the production (company or country mix),
- Similar installation and end-of-life, adapted to the country where the product is sold.

3.10 COMPARABILITY

A comparison or evaluation of EPD data is only possible if all datasets are made following EN 15804, applying the same relevant product category rules and for the same modules.

4. DATA

4.1 DATA QUALITY

The data used for the LCA are for a group of products manufactured in multiple production sites. The data about the process and products are based upon frequent contact with the production sites to guarantee that this EPD is based on the most up-to-date production data. Missing data was collected from Ecoinvent version 3.9.

4.2 PERIOD OF DATA COLLECTION

The data was collected and updated in 2022 based on specific company impacts. Separate data was collected from each manufacturing site/company. The results are averaged according to the quantities sold by each plant after being assessed individually.

4.3 DATABASE USED FOR BACKGROUND DATA

Ecoinvent version 3.9 was used to cover the required background data.

4.4 ENERGY MIX

Company-specific energy mix (or country-specific grid mix) was used to produce the insulation product. The country of installation's energy mix is considered for installing the product in the building. The energy mix of the product's final application market is used to declare the benefits beyond the system boundaries (module D).

4.5 QUALITATIVE INFORMATION

Loose fill cellulose insulation products from the members of ECIA are made according to the production protocols of the companies, European technical specifications and their national standards.

5. SYSTEM BOUNDARIES

Product stage			Construction installation stage		Use stage							End-of-life stage				Beyond the system boundaries
Raw materials	Transport	Manufacturing	Transport	Construction installation stage	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
☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒

Table 5: Modules over the life cycle of a building material as determined in EN 15804+A2

X = included in the EPD; MND = module not declared; IRR = module not relevant

6. LIFE CYCLE STAGES

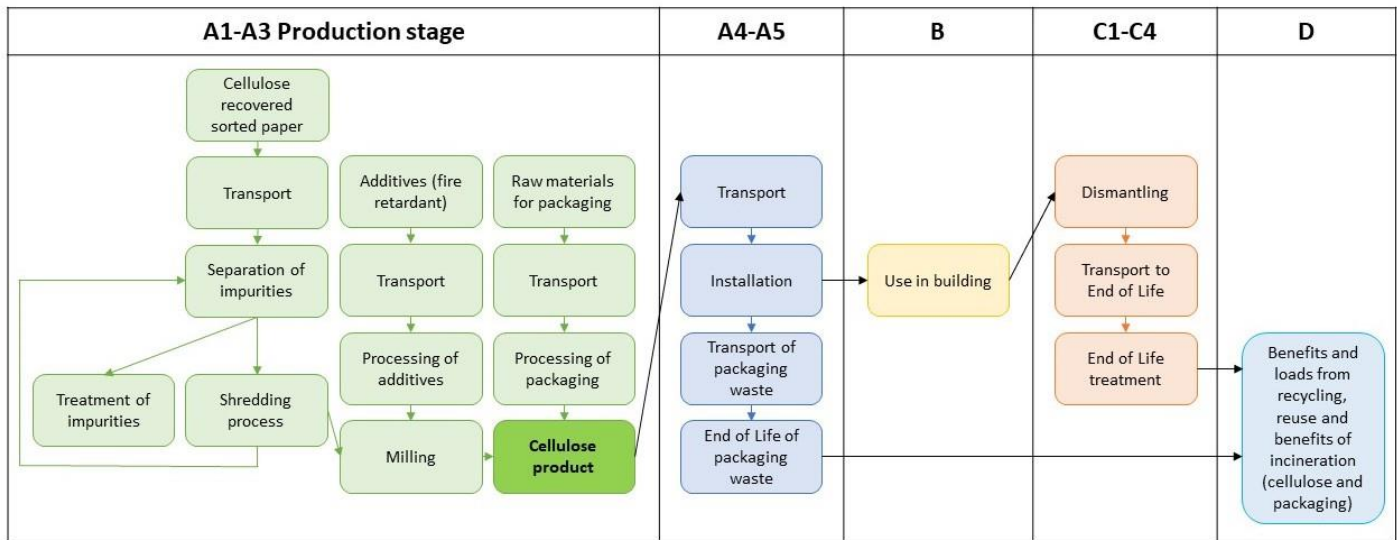


Figure 5: Flowchart illustrating the life cycle of cellulose insulation products

6.1 PRODUCT STAGE (A1-3)

The recovered paper is transported to the cellulose insulation production plant. The impurities are separated, and the paper is shredded. Paper, which still contains tiny amounts of impurities, is recycled into the process. When milling the shredded paper, fire retardants are added. The final product is packed and transported to the retailer or the construction site.

6.2 CONSTRUCTION STAGE (A4-5)

6.2.1 Transport to building site (A4)

The final product is packed and transported to the construction site. Wherever the case, the transport is volume-based as the insulation product has a low density. A compression factor of the material during transportation is considered. There is a wide variety of distances and vehicles used by the producers. The average transport distance from production to the building site is 353 km based on the average market share for loose fill cellulose insulation.

6.2.2 Installation of the product in the building (A5)

The loose fill cellulose insulation is applied into the construction by a machine. Therefore, the energy consumption of the blowing or spraying machine is considered.

6.3 USE STAGE (B1-7)

If installed correctly according to the manufacturers' and suppliers' guidelines, loose fill cellulose insulation products need no further maintenance, repair, replacement or refurbishment during the full lifespan of the product. If the product is applied following the installation instructions, a lifespan of 50 years is applicable.

6.4 END-OF-LIFE STAGE (C1-4)

6.4.1 Demolition (C1)

The dismantling is very easy: the cellulose material can be sucked with a hose to a truck and may be reused or recycled if appropriate. This process is a fast reverse of the installation process. Although cellulose is easily

reclaimed as recyclable and reusable, the current practice in each country is used as the basis for the modelling of the product.

6.4.2 Transport (C2)

Assumptions for the transport phase: 50 km to the landfilling site and 100 km to the incineration site. Transport with a Euro 5, with a 16-32 t total weight lorry.

6.4.3 Waste processing (C3-C4)

Although cellulose is easily recyclable and reusable, these scenarios are not yet mainstreamed in Europe. The waste scenario is defined as incineration with energy recovery, landfilling and a small share of recycling. Market share in different EU countries and different scenarios per country have been used.











6.5 BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARY (D)

The avoided energy production due to the incineration of the loose fill cellulose insulation products is considered a benefit beyond the system boundary. Avoided production of virgin materials due to recycling is also considered in this module.

7. LIFE CYCLE ASSESSMENT RESULTS FOR LOOSE FILL CELLULOSE INSULATION PRODUCT

7.1 ENVIRONMENTAL IMPACTS FOR LOOSE FILL CELLULOSE INSULATION PRODUCTS

The results of the LCIA are calculated by merging the results at the product level using the market shares. The results for 1kg of average insulation product are provided in Table 6, Table 7, Table 8, and Table 9.

		A1 Raw material	A2 Transport	A3 manufacturing	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repairs	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use
	GWP total (kg CO2 equiv/FU)	-1.28E+00	4.23E-02	-3.83E-02	6.41E-02	1.10E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	GWP fossil (kg CO2 equiv/FU)	5.86E-02	4.23E-02	5.47E-02	6.41E-02	1.66E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	GWP biogenic (kg CO2 equiv/FU)	-1.34E+00	0.00E+00	-9.34E-02	0.00E+00	9.34E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	GWP luluc (kg CO2 equiv/FU)	9.35E-05	2.02E-05	3.98E-04	3.05E-05	8.04E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	ODP (kg CFC 11 equiv/FU)	1.22E-09	8.95E-10	1.04E-09	1.36E-09	9.65E-11	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	AP (mol H+ eq/FU)	9.16E-04	1.51E-04	2.40E-04	2.09E-04	2.27E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	EP - freshwater (kg (PO4)3- equiv/FU)	2.87E-06	3.29E-07	2.30E-06	4.99E-07	1.74E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	EP - marine (kg (PO4)3- equiv/FU)	9.48E-05	4.99E-05	5.66E-05	7.07E-05	7.80E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	EP - terrestrial (kg (PO4)3- equiv/FU)	1.05E-03	5.35E-04	6.56E-04	7.56E-04	8.23E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	POCP (kg Ethene equiv/FU)	3.46E-04	2.16E-04	2.51E-04	3.10E-04	2.58E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	ADP Elements (kg Sb equiv/FU)	3.59E-05	1.23E-07	3.11E-07	1.96E-07	1.09E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	ADP fossil fuels (MJ/FU)	9.17E-01	5.90E-01	1.41E+00	8.88E-01	7.78E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	WDP (m³ water eq deprived /FU)	4.52E-02	2.59E-03	2.10E-02	3.75E-03	7.20E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

GWP = GLOBAL WARMING POTENTIAL (CLIMATE CHANGE); **ODP** = OZONE DEPLETION POTENTIAL; **AP** = ACIDIFICATION POTENTIAL FOR SOIL AND WATER; **EP** = EUTROPHICATION; **ADPE** = ABIOTIC DEPLETION POTENTIAL – ELEMENTS; **ADPF** = ABIOTIC DEPLETION POTENTIAL – FOSSIL FUELS

Table 6: Environmental impacts for 1 kg of loose fill insulation product







	Production			Construction process stage		Use stage						
	A1 Raw material	A2 Transport	A3 manufacturing	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repairs	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use
PERE (MJ/UF, net calorific value)	1.07E-01	8.91E-03	1.04E+00	1.36E-02	4.44E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERM (MJ/UF, net calorific value)	1.33E+01	0.00E+00	7.56E-01	0.00E+00	-6.57E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT (MJ/UF, net calorific value)	1.34E+01	8.91E-03	1.80E+00	1.36E-02	-2.13E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRE (MJ/UF, net calorific value)	1.08E+00	6.00E-01	1.52E+00	9.03E-01	3.22E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRM (MJ/UF, net calorific value)	0.00E+00	0.00E+00	3.90E-01	0.00E+00	-3.38E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT (MJ/UF, net calorific value)	1.08E+00	6.00E-01	1.91E+00	9.03E-01	-1.56E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SM (kg/UF)	9.13E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF (MJ/UF, net calorific value)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF (MJ/UF, net calorific value)	0.00E+00	0.00E+00	-5.20E-04	0.00E+00	-1.04E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW (m³ eq. water /UF)	-6.10E-03	-2.07E-04	-5.45E-03	-3.27E-04	-1.88E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

PERE = USE OF RENEWABLE PRIMARY ENERGY EXCLUDING RENEWABLE PRIMARY ENERGY RESOURCES USED AS RAW MATERIALS; **PERM** = USE OF RENEWABLE PRIMARY ENERGY RESOURCES; **PERT** = TOTAL USE OF RENEWABLE PRIMARY ENERGY RESOURCES; **PENRE** = USE OF NON-RENEWABLE PRIMARY ENERGY EXCLUDING NON-RENEWABLE PRIMARY ENERGY RESOURCES USED AS RAW MATERIALS; **PENRT** = TOTAL USE OF NON-RENEWABLE PRIMARY ENERGY RESOURCES; **SM** = SECONDARY FUELS; **NRSF** = USE OF NON-RENEWABLE SECONDARY FUELS; **FW** = NET USE OF FRESH WATER

Table 7: Environmental impacts for 1 kg of loose fill insulation product - resource use indicators

	A1 Raw material	A2 Transport	A3 manufacturing	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repairs	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use
Hazardous waste disposed EU (kg/UF)	0.00E+00	0.00E+00	1.78E-06	0.00E+00	3.57E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Non hazardous waste disposed EU (kg/UF)	0.00E+00	0.00E+00	3.72E-05	0.00E+00	8.66E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Radioactive waste disposed EU (kg/UF)	0.00E+00	0.00E+00	7.00E-09	0.00E+00	3.50E-11	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Components for reuse (kg/UF)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for recycling (kg/UF)	0.00E+00	0.00E+00	4.96E-07	0.00E+00	1.93E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for energy recovery (kg/UF)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.76E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy (kg/UF)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.00E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 8: Environmental impacts for 1 kg of loose fill insulation product - waste categories & outputs

		Production			Construction process stage		Use stage						
		A1 Raw material	A2 Transport	A3 manufacturing	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repairs	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use
	Particulate matter (disease inc.)	1.12E-08	3.57E-09	2.95E-09	5.12E-09	2.62E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Ionising radiation (kBq U-235 eq)	3.64E-03	2.90E-04	6.87E-03	4.42E-04	6.71E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Ecotoxicity, freshwater (CTUe)	3.77E-01	3.11E-01	2.29E-01	4.69E-01	2.84E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Human toxicity, cancer (CTUh)	3.72E-11	1.84E-11	7.33E-11	2.81E-11	1.03E-11	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Human toxicity, non-cancer (CTUh)	1.37E-09	5.45E-10	7.67E-10	8.22E-10	9.55E-11	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Land use (Pt)	3.67E-01	4.44E-01	3.93E+00	5.78E-01	3.67E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00











HTCE = HUMAN TOXICITY – CANCER EFFECTS;
HTNCE = HUMAN TOXICITY – NON CANCER EFFECTS;
ETF = ECOTOXICITY – FRESHWATER;
PM = PARTICULATE MATTER;
IRHH = IONIZING RADIATION – HUMAN HEALTH EFFECTS

Table 9: Environmental impacts for 1 kg of loose fill insulation product - additional indicators

7.2 ENVIRONMENTAL IMPACTS FOR LOOSE FILL CELLULOSE INSULATION PRODUCTS IN OPEN-BLOWING ATTICS APPLICATIONS

The results of the LCIA are calculated for each application by merging the results at the product level using the market shares. The results for 1m² of insulated open-blowing attics (with an R-value equal to 7 m².K/W) are provided in Table 10, Table 11, Table 12 and Table 13. The average installed density³ used for the calculation is 32.0 kg/m³ in an open-blowing application.

³ Average density is obtained based on weighted average (based on sale volume) of the declared density provided by the participating companies.

		A1 Raw material	A2 Transport	A3 manufacturing	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repairs	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use
	GWP total (kg CO ₂ equiv/FU)	-1.10E+01	3.63E-01	-3.28E-01	5.49E-01	9.42E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	GWP fossil (kg CO ₂ equiv/FU)	5.02E-01	3.63E-01	4.69E-01	5.49E-01	1.42E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	GWP biogenic (kg CO ₂ equiv/FU)	-1.15E+01	0.00E+00	-8.00E-01	0.00E+00	8.00E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	GWP luluc (kg CO ₂ equiv/FU)	8.01E-04	1.73E-04	3.41E-03	2.61E-04	6.89E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	ODP (kg CFC 11 equiv/FU)	1.05E-08	7.66E-09	8.94E-09	1.16E-08	8.26E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	AP (mol H ⁺ eq/FU)	7.84E-03	1.30E-03	2.05E-03	1.79E-03	1.94E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	EP - freshwater (kg (PO ₄) ₃ -equiv/FU)	2.46E-05	2.82E-06	1.97E-05	4.28E-06	1.49E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	EP - marine (kg (PO ₄) ₃ -equiv/FU)	8.12E-04	4.27E-04	4.85E-04	6.05E-04	6.68E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	EP - terrestrial (kg (PO ₄) ₃ -equiv/FU)	9.00E-03	4.58E-03	5.62E-03	6.48E-03	7.05E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	POCP (kg Ethene equiv/FU)	2.97E-03	1.85E-03	2.15E-03	2.66E-03	2.21E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	ADP Elements (kg Sb equiv/FU)	3.07E-04	1.06E-06	2.66E-06	1.68E-06	9.30E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	ADP fossil fuels (MJ/FU)	7.85E+00	5.06E+00	1.21E+01	7.61E+00	6.67E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	WDP (m ³ water eq deprived /FU)	3.88E-01	2.22E-02	1.80E-01	3.21E-02	6.17E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

GWP = GLOBAL WARMING POTENTIAL (CLIMATE CHANGE); **ODP** = OZONE DEPLETION POTENTIAL; **AP** = ACIDIFICATION POTENTIAL FOR SOIL AND WATER; **EP** = EUTROPHICATION; **ADPE** = ABIOTIC DEPLETION POTENTIAL – ELEMENTS; **ADPF** = ABIOTIC DEPLETION POTENTIAL – FOSSIL FUELS

Table 10: Environmental impacts for 1 m² of loose fill insulation product in open blowing attics appl







	Production			Construction process stage		Use stage						
	A1 Raw material	A2 Transport	A3 manufacturing	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repairs	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use
PERE (MJ/UF, net calorific value)	9.18E-01	7.63E-02	8.91E+00	1.17E-01	3.80E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERM (MJ/UF, net calorific value)	1.14E+02	0.00E+00	6.48E+00	0.00E+00	-5.63E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT (MJ/UF, net calorific value)	1.15E+02	7.63E-02	1.54E+01	1.17E-01	-1.83E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRE (MJ/UF, net calorific value)	9.24E+00	5.14E+00	1.30E+01	7.74E+00	2.76E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRM (MJ/UF, net calorific value)	0.00E+00	0.00E+00	3.34E+00	0.00E+00	-2.89E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT (MJ/UF, net calorific value)	9.24E+00	5.14E+00	1.64E+01	7.74E+00	-1.33E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SM (kg/UF)	7.82E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF (MJ/UF, net calorific value)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF (MJ/UF, net calorific value)	0.00E+00	0.00E+00	-4.45E-03	0.00E+00	-8.91E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW (m³ eq. water /UF)	-5.23E-02	-1.77E-03	-4.67E-02	-2.80E-03	-1.61E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

PERE = USE OF RENEWABLE PRIMARY ENERGY EXCLUDING RENEWABLE PRIMARY ENERGY RESOURCES USED AS RAW MATERIALS; **PERM** = USE OF RENEWABLE PRIMARY ENERGY RESOURCES; **PERT** = TOTAL USE OF RENEWABLE PRIMARY ENERGY RESOURCES; **PENRE** = USE OF NON-RENEWABLE PRIMARY ENERGY EXCLUDING NON-RENEWABLE PRIMARY ENERGY RESOURCES USED AS RAW MATERIALS; **PENRM** = USE OF NON-RENEWABLE PRIMARY ENERGY RESOURCES EXCLUDING NON-RENEWABLE PRIMARY ENERGY RESOURCES USED AS RAW MATERIALS; **PENRT** = TOTAL USE OF NON-RENEWABLE PRIMARY ENERGY RESOURCES; **SM** = SECONDARY FUELS; **NRSF** = USE OF NON-RENEWABLE SECONDARY FUELS; **FW** = NET USE OF FRESH WATER

Table 11: Environmental impacts for 1 m² of loose fill insulation product in open blowing attics applications

	A1 Raw material	A2 Transport	A3 manufacturing	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repairs	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use
Hazardous waste disposed EU (kg/UF)	0.00E+00	0.00E+00	1.53E-05	0.00E+00	3.06E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Non hazardous waste disposed EU (kg/UF)	0.00E+00	0.00E+00	3.19E-04	0.00E+00	7.42E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Radioactive waste disposed EU (kg/UF)	0.00E+00	0.00E+00	5.99E-08	0.00E+00	3.00E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Components for reuse (kg/UF)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for recycling (kg/UF)	0.00E+00	0.00E+00	4.25E-06	0.00E+00	1.65E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for energy recovery (kg/UF)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.22E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy (kg/UF)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.71E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 12: Environmental impacts for 1 m² of loose fill insulation product in open blowing attics applications - was

		Production			Construction process stage		Use stage						
		A1 Raw material	A2 Transport	A3 manufacturing	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repairs	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use
	Particulate matter (disease inc.)	9.64E-08	3.06E-08	2.53E-08	4.38E-08	2.25E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Ionising radiation (kBq U-235 eq)	3.12E-02	2.48E-03	5.89E-02	3.79E-03	5.75E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Ecotoxicity, freshwater (CTUe)	3.23E+00	2.66E+00	1.96E+00	4.01E+00	2.44E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Human toxicity, cancer (CTUh)	3.19E-10	1.58E-10	6.28E-10	2.41E-10	8.80E-11	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Human toxicity, non-cancer (CTUh)	1.17E-08	4.67E-09	6.57E-09	7.04E-09	8.18E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Land use (Pt)	3.14E+00	3.81E+00	3.37E+01	4.95E+00	3.14E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00











HTCE = HUMAN TOXICITY – CANCER EFFECTS;
HTNCE = HUMAN TOXICITY – NON CANCER EFFECTS;
ETF = ECOTOXICITY – FRESHWATER;
PM = PARTICULATE MATTER;
IRHH = IONIZING RADIATION – HUMAN HEALTH EFFECTS

Table 13: Environmental impacts for 1 m² of loose fill insulation product in open blowing attics applications - addit

7.3 ENVIRONMENTAL IMPACTS FOR LOOSE FILL CELLULOSE INSULATION PRODUCTS IN ROOF APPLICATIONS (PITCHED ROOF)

The results of the LCIA are calculated for each application by merging the results at the product level using the market shares. The results for 1m² of the insulated pitched roof (with an R-value equal to 7 m².K/W) are provided in Table 14, Table 15, Table 16 and Table 17. The average installed density⁴ used for the calculation is 49.0 kg/m³ in a pitched roof application.

⁴ Average density is obtained based on weighted average (based on sale volume) of the declared density provided by the participating companies.

		A1 Raw material	A2 Transport	A3 manufacturing	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repairs	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use
	GWP total (kg CO ₂ equiv/FU)	-1.68E+01	5.56E-01	-5.02E-01	8.41E-01	1.44E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	GWP fossil (kg CO ₂ equiv/FU)	7.69E-01	5.55E-01	7.18E-01	8.41E-01	2.18E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	GWP biogenic (kg CO ₂ equiv/FU)	-1.76E+01	0.00E+00	-1.23E+00	0.00E+00	1.23E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	GWP luluc (kg CO ₂ equiv/FU)	1.23E-03	2.65E-04	5.22E-03	4.00E-04	1.06E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	ODP (kg CFC 11 equiv/FU)	1.60E-08	1.17E-08	1.37E-08	1.78E-08	1.27E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	AP (mol H ⁺ eq/FU)	1.20E-02	1.99E-03	3.14E-03	2.75E-03	2.98E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	EP - freshwater (kg (PO ₄) ₃ -equiv/FU)	3.77E-05	4.32E-06	3.02E-05	6.55E-06	2.28E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	EP - marine (kg (PO ₄) ₃ -equiv/FU)	1.24E-03	6.55E-04	7.43E-04	9.28E-04	1.02E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	EP - terrestrial (kg (PO ₄) ₃ -equiv/FU)	1.38E-02	7.02E-03	8.60E-03	9.92E-03	1.08E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	POCP (kg Ethene equiv/FU)	4.54E-03	2.84E-03	3.29E-03	4.07E-03	3.38E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	ADP Elements (kg Sb equiv/FU)	4.71E-04	1.62E-06	4.08E-06	2.57E-06	1.42E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	ADPF fossil fuels (MJ/FU)	1.20E+01	7.75E+00	1.85E+01	1.17E+01	1.02E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	WDP (m ³ water eq deprived /FU)	5.94E-01	3.40E-02	2.75E-01	4.92E-02	9.46E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

GWP = GLOBAL WARMING POTENTIAL (CLIMATE CHANGE); **ODP** = OZONE DEPLETION POTENTIAL; **AP** = ACIDIFICATION POTENTIAL FOR SOIL AND WATER; **EP** = EUTROPHICATION; **ADPE** = ABIOTIC DEPLETION POTENTIAL – ELEMENTS; **ADPF** = ABIOTIC DEPLETION POTENTIAL – FOSSIL FUELS

Table 14: Environmental impacts for 1 m² of loose fill insulation product in pitched roof application







	Production			Construction process stage		Use stage						
	A1 Raw material	A2 Transport	A3 manufacturing	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repairs	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use
PERE (MJ/UF, net calorific value)	1.41E+00	1.17E-01	1.36E+01	1.79E-01	5.83E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERM (MJ/UF, net calorific value)	1.75E+02	0.00E+00	9.93E+00	0.00E+00	-8.63E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT (MJ/UF, net calorific value)	1.76E+02	1.17E-01	2.36E+01	1.79E-01	-2.80E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRE (MJ/UF, net calorific value)	1.42E+01	7.88E+00	1.99E+01	1.19E+01	4.23E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRM (MJ/UF, net calorific value)	0.00E+00	0.00E+00	5.12E+00	0.00E+00	-4.43E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT (MJ/UF, net calorific value)	1.42E+01	7.88E+00	2.51E+01	1.19E+01	-2.04E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SM (kg/UF)	1.20E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF (MJ/UF, net calorific value)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF (MJ/UF, net calorific value)	0.00E+00	0.00E+00	-6.82E-03	0.00E+00	-1.36E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW (m³ eq. water /UF)	-8.01E-02	-2.71E-03	-7.15E-02	-4.29E-03	-2.47E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

PERE = USE OF RENEWABLE PRIMARY ENERGY EXCLUDING RENEWABLE PRIMARY ENERGY RESOURCES USED AS RAW MATERIALS; **PERM** = USE OF RENEWABLE PRIMARY ENERGY RESOURCES; **PERT** = TOTAL USE OF RENEWABLE PRIMARY ENERGY RESOURCES; **PENRE** = USE OF NON-RENEWABLE PRIMARY ENERGY EXCLUDING NON-RENEWABLE PRIMARY ENERGY RESOURCES USED AS RAW MATERIALS; **PENRM** = TOTAL USE OF NON-RENEWABLE PRIMARY ENERGY RESOURCES; **PENRT** = TOTAL USE OF NON-RENEWABLE PRIMARY ENERGY RESOURCES; **SM** = SECONDARY FUELS; **NRSF** = USE OF NON-RENEWABLE SECONDARY FUELS; **FW** = NET USE OF FRESH WATER

Table 15: Environmental impacts for 1 m² of loose fill insulation product in pitched roof applications - resource

	A1 Raw material	A2 Transport	A3 manufacturing	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repairs	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use
Hazardous waste disposed EU (kg/UF)	0.00E+00	0.00E+00	2.34E-05	0.00E+00	4.68E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Non hazardous waste disposed EU (kg/UF)	0.00E+00	0.00E+00	4.89E-04	0.00E+00	1.14E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Radioactive waste disposed EU (kg/UF)	0.00E+00	0.00E+00	9.18E-08	0.00E+00	4.59E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Components for reuse (kg/UF)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for recycling (kg/UF)	0.00E+00	0.00E+00	6.51E-06	0.00E+00	2.53E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for energy recovery (kg/UF)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.93E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy (kg/UF)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.62E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 16: Environmental impacts for 1 m² of loose fill insulation product in pitched roof applications - waste category

		Production			Construction process stage		Use stage						
		A1 Raw material	A2 Transport	A3 manufacturing	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repairs	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use
	Particulate matter (disease inc.)	1.48E-07	4.69E-08	3.88E-08	6.72E-08	3.44E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Ionising radiation (kBq U-235 eq)	4.78E-02	3.81E-03	9.02E-02	5.80E-03	8.81E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Ecotoxicity, freshwater (CTUe)	4.95E+00	4.08E+00	3.00E+00	6.15E+00	3.73E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Human toxicity, cancer (CTUh)	4.89E-10	2.41E-10	9.62E-10	3.69E-10	1.35E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Human toxicity, non-cancer (CTUh)	1.80E-08	7.15E-09	1.01E-08	1.08E-08	1.25E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Land use (Pt)	4.81E+00	5.83E+00	5.16E+01	7.59E+00	4.82E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00











HTCE = HUMAN TOXICITY – CANCER EFFECTS;
HTNCE = HUMAN TOXICITY – NON CANCER EFFECTS;
ETF = ECOTOXICITY – FRESHWATER;
PM = PARTICULATE MATTER;
IRHH = IONIZING RADIATION – HUMAN HEALTH EFFECTS

Table 17: Environmental impacts for 1 m² of loose fill insulation product in pitched roof applications - addition

7.4 ENVIRONMENTAL IMPACTS FOR LOOSE FILL CELLULOSE INSULATION PRODUCTS IN WALL APPLICATIONS

The results of the LCIA are calculated for each application by merging the results at the product level using the market shares. The results for 1m² of the insulated wall (with an R-value equal to 3.5 m²·K/W) are provided in Table 18, Table 19, Table 20 and Table 21. The average installed density⁵ used for the calculation is 50.7 kg/m³ in wall application.

⁵ Average density is obtained based on weighted average (based on sale volume) of the declared density provided by the participating companies.

		A1 Raw material	A2 Transport	A3 manufacturing	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repairs	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use
	GWP total (kg CO ₂ equiv/FU)	-8.69E+00	2.87E-01	-2.60E-01	4.35E-01	7.46E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	GWP fossil (kg CO ₂ equiv/FU)	3.98E-01	2.87E-01	3.71E-01	4.35E-01	1.13E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	GWP biogenic (kg CO ₂ equiv/FU)	-9.09E+00	0.00E+00	-6.34E-01	0.00E+00	6.34E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	GWP luluc (kg CO ₂ equiv/FU)	6.35E-04	1.37E-04	2.70E-03	2.07E-04	5.46E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	ODP (kg CFC 11 equiv/FU)	8.28E-09	6.07E-09	7.08E-09	9.21E-09	6.55E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	AP (mol H ⁺ eq/FU)	6.22E-03	1.03E-03	1.63E-03	1.42E-03	1.54E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	EP - freshwater (kg (PO ₄) ₃ -equiv/FU)	1.95E-05	2.23E-06	1.56E-05	3.39E-06	1.18E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	EP - marine (kg (PO ₄) ₃ -equiv/FU)	6.43E-04	3.39E-04	3.84E-04	4.80E-04	5.30E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	EP - terrestrial (kg (PO ₄) ₃ -equiv/FU)	7.13E-03	3.63E-03	4.45E-03	5.13E-03	5.59E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	POCP (kg Ethene equiv/FU)	2.35E-03	1.47E-03	1.70E-03	2.11E-03	1.75E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	ADP Elements (kg Sb equiv/FU)	2.43E-04	8.36E-07	2.11E-06	1.33E-06	7.37E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	ADPF fossil fuels (MJ/FU)	6.22E+00	4.01E+00	9.59E+00	6.03E+00	5.28E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	WDP (m ³ water eq deprived /FU)	3.07E-01	1.76E-02	1.42E-01	2.55E-02	4.89E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

GWP = GLOBAL WARMING POTENTIAL (CLIMATE CHANGE); **ODP** = OZONE DEPLETION POTENTIAL; **AP** = ACIDIFICATION POTENTIAL FOR SOIL AND WATER; **EP** = EUTROPHICATION; **ADPE** = ABIOTIC DEPLETION POTENTIAL – ELEMENTS; **ADPF** = ABIOTIC DEPLETION POTENTIAL – FOSSIL FUELS

Table 18: Environmental impacts for 1 m² of loose fill insulation product in wall application







	Production			Construction process stage		Use stage						
	A1 Raw material	A2 Transport	A3 manufacturing	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repairs	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use
PERE (MJ/UF, net calorific value)	7.27E-01	6.05E-02	7.06E+00	9.26E-02	3.01E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERM (MJ/UF, net calorific value)	9.03E+01	0.00E+00	5.13E+00	0.00E+00	-4.46E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT (MJ/UF, net calorific value)	9.10E+01	6.05E-02	1.22E+01	9.26E-02	-1.45E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRE (MJ/UF, net calorific value)	7.32E+00	4.07E+00	1.03E+01	6.13E+00	2.19E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRM (MJ/UF, net calorific value)	0.00E+00	0.00E+00	2.65E+00	0.00E+00	-2.29E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT (MJ/UF, net calorific value)	7.32E+00	4.07E+00	1.30E+01	6.13E+00	-1.06E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SM (kg/UF)	6.20E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF (MJ/UF, net calorific value)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF (MJ/UF, net calorific value)	0.00E+00	0.00E+00	-3.53E-03	0.00E+00	-7.06E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW (m³ eq. water /UF)	-4.14E-02	-1.40E-03	-3.70E-02	-2.22E-03	-1.28E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

PERE = USE OF RENEWABLE PRIMARY ENERGY EXCLUDING RENEWABLE PRIMARY ENERGY RESOURCES USED AS RAW MATERIALS; **PERM** = USE OF RENEWABLE PRIMARY ENERGY RESOURCES; **PERT** = TOTAL USE OF RENEWABLE PRIMARY ENERGY RESOURCES; **PENRE** = USE OF NON-RENEWABLE PRIMARY ENERGY EXCLUDING NON-RENEWABLE PRIMARY ENERGY RESOURCES USED AS RAW MATERIALS; **PENRM** = TOTAL USE OF NON-RENEWABLE PRIMARY ENERGY RESOURCES; **PENRT** = TOTAL USE OF NON-RENEWABLE PRIMARY ENERGY RESOURCES; **SM** = SECONDARY FUELS; **NRSF** = USE OF NON-RENEWABLE SECONDARY FUELS; **FW** = NET USE OF FRESH WATER

Table 19: Environmental impacts for 1 m² of loose fill insulation product in wall applications - resource use

	A1 Raw material	A2 Transport	A3 manufacturing	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repairs	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use
Hazardous waste disposed EU (kg/UF)	0.00E+00	0.00E+00	1.21E-05	0.00E+00	2.42E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Non hazardous waste disposed EU (kg/UF)	0.00E+00	0.00E+00	2.53E-04	0.00E+00	5.88E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Radioactive waste disposed EU (kg/UF)	0.00E+00	0.00E+00	4.75E-08	0.00E+00	2.37E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Components for reuse (kg/UF)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for recycling (kg/UF)	0.00E+00	0.00E+00	3.37E-06	0.00E+00	1.31E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for energy recovery (kg/UF)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.55E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy (kg/UF)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.36E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 20: Environmental impacts for 1 m² of loose fill insulation product in wall applications - waste categories

		Production			Construction process stage		Use stage						
		A1 Raw material	A2 Transport	A3 manufacturing	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repairs	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use
	Particulate matter (disease inc.)	7.64E-08	2.43E-08	2.01E-08	3.47E-08	1.78E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Ionising radiation (kBq U-235 eq)	2.47E-02	1.97E-03	4.66E-02	3.00E-03	4.56E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Ecotoxicity, freshwater (CTUe)	2.56E+00	2.11E+00	1.55E+00	3.18E+00	1.93E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Human toxicity, cancer (CTUh)	2.53E-10	1.25E-10	4.98E-10	1.91E-10	6.97E-11	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Human toxicity, non-cancer (CTUh)	9.30E-09	3.70E-09	5.20E-09	5.58E-09	6.48E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Land use (Pt)	2.49E+00	3.02E+00	2.67E+01	3.92E+00	2.49E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

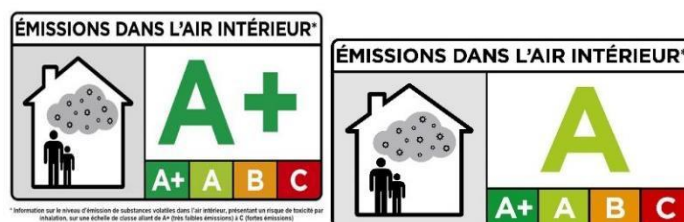
HTCE = HUMAN TOXICITY – CANCER EFFECTS;
HTNCE = HUMAN TOXICITY – NON CANCER EFFECTS;
ETF = ECOTOXICITY – FRESHWATER;
PM = PARTICULATE MATTER;
IRHH = IONIZING RADIATION – HUMAN HEALTH EFFECTS

Table 21: Environmental impacts for 1 m² of loose fill insulation product in wall applications - additional i

8. ADDITIONAL INFORMATION ON RELEASE OF DANGEROUS SUBSTANCES TO INDOOR AIR, SOIL, AND WATER DURING THE USE STAGE

8.1 INDOOR AIR

The VOC emission test, as part of mandatory environmental labelling, was carried out according to NF ISO EN 16000-3, NF ISO EN 16000- 6, NF ISO EN 16000-9 and NF ISO EN 16000-11. The loose fill cellulose insulation is rated as A + or A depending on the product and its application (roof, wall, attic).



8.2 SOIL AND WATER

Not applicable as this product is not in contact with drinking water, runoff water, seepage water, or surface water.

Owner of the EPD Responsible for data, LCA and information	European Cellulose Insulation Association (ECIA) Dreve du Pressoir 38 1190 Forest Brussels, Belgium www.ecia.eu.com	
Author(s) of the LCA and EPD	WeLOOP 254 Rue du Bourg 59130 Lambersart France	
Project report	Environmental Product Declaration Background Report – Loose Fill Cellulose Insulation, version 1	
Verification Name of the third-party verifier Date of verification	NF EN 15804+A2 Frank Werner 11/12/2023	

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