



Environmental Product Declaration

In accordance with CAN/CSA-ISO 14025:2006 and ISO 21930:2017

IGLOO Cellulose Insulation



Igloo Cellulose Inc. is pleased to present this Environmental Product Declaration (EPD) for IGLOO Cellulose thermal insulation. This EPD was developed in compliance with ISO 14025[3] and has been verified by Charles Thibodeau.

The LCA and the EPD were prepared by WeLOOP. The EPD includes cradle-to-grave life cycle assessment (LCA) results.

For more information about IGLOO Cellulose insulation, visit <https://cellulose.com/product>.

For any explanatory material regarding this EPD, please contact the program operator.

1. GENERAL INFORMATION

This environmental product declaration (EPD) is in accordance with CAN/CSA-ISO 14025:2006[3] and the PCRs noted below. ISO 21930:2017[4] serves as the core PCR along with the UL Environment PCR Part A[5] and Part B[7]. EPDs are comparable only if they comply with ISO 21930:2017[4], use the same sub-category PCR, include all relevant information modules and are based on equivalent scenarios with respect to the context of construction works. Comparison of the environmental performance of insulation products using EPD information shall be based on the product's use and impacts at the building level, and therefore, EPDs may not be used for comparability purposes when not considering the building energy use phase as instructed under this PCR. Full conformance with the PCR for insulation products allows EPD comparability only when all stages of a life cycle have been considered, when they comply with all referenced standards, use the same sub-category PCR, and use equivalent scenarios with respect to construction works. However, variations and deviations are possible. Example of variations: Different LCA software and background LCI datasets may lead to differences in results for upstream or downstream of the life cycle stages declared.

Program Operator	ASTM International 100 Barr Harbor Drive West Conshohocken, PA 19428 United States of America (USA) www.astm.org	
Product	IGLOO Cellulose insulation	
Functional Unit	1 m ² of installed cellulose insulation material with a thickness that gives an average thermal resistance RSI = 1 m ² K/W and with a building service life of 75 years (packaging included)	
Application	This EPD provides results based on the functional unit defined for IGLOO Cellulose for each application: <ul style="list-style-type: none"> • Loose fill application (attics) • Dense-pack application (wall) 	
EPD registration number	EPD 910	
EPD recipient organization	Igloo Cellulose Inc. 1485, route Transcanadienne Dorval (Quebec) H9V 2V3 Canada https://cellulose.com/home	
Reference PCR	PCR Part A: UL Environment Building Related Products and Services. Life cycle assessment calculation rules and report requirements, v4.0. March 2022. Standard 10010 PCR Part B: Building Envelope Thermal Insulation EPD Requirements, UL 10010-1, v3.0. April 2023. UL 10010-03	
Market of applicability	Canada and USA	
Type of EPD	Product Specific	
Year of reported manufacturer primary data	2023	
LCA Software	SimaPro v.9.5.0.0 (July 2023)[10]	
LCA database	Ecoinvent 3.9.1 (December 2022) [9]	
LCIA methodology	TRACI 2.1, IPCC (2013) and CML baseline	
Date of issue	February 14, 2025	
Period of validity	February 2025 – February 2030	
This PCR review was conducted by:	Part A: Lindita Bushi, PhD, Chair	



	<p>Athena Sustainable Materials Institute lindita.bushi@athenasmi.org</p> <p>Hugues Imbeault-Tétreault, Eng., M.A.Sc. Groupe AGÉCO hugues.i-tetreault@groupeageco.ca</p> <p>Jack Geibig Ecoform jgeibig@ecoform.com</p> <p>Part B: Thomas Gloria, PhD (chair) Industrial Ecology Consultants t.gloria@industrial-ecology.com</p> <p>Christoph Koffler, PhD thinkstep christoph.koffler@thinkstep.com</p> <p>Andre Desjarlais Oak Ridge National Laboratory desjarlaisa@ornl.gov</p>
<p>This EPD and related data were independently verified by an external verifier according to CAN/CSA-ISO 14025:2006, ISO 21930:2017, EN 15804:2012 and UL Part A</p>	<p><input type="checkbox"/> Internal <input checked="" type="checkbox"/> External</p> <p><i>Charles Thibodeau</i></p> <p>Charles Thibodeau, CT Consultant</p>
<p>Additional information</p>	<p>Additional information is available at https://cellulose.com/home Or by contacting by email igloo@cellulose.com</p>

2. INTRODUCTION TO IGLOO CELLULOSE INC.

Igloo Cellulose Inc. is a Canadian cellulose insulation manufacturer. It was founded in 1978 by the late Russell Fiset. Already pioneers in the field at the time, the company's focus on research and development and the optimization and refinement of its production processes resulted in a high-end product that is efficient, safe, and in line with its environmental imperatives. In March 2020, ISO-GREEN (France), along with its partners Harnam Kakkar, FCPA, FCMA, and Daniel Béland B. Sc. A., MBA, acquired 100% of the shares of Igloo Cellulose Inc. from the Fiset family. Igloo Cellulose Inc. is dedicated to enhancing the energy efficiency and comfort of residential housing while demonstrating environmental sensitivity. The company achieves this by transforming and recycling recovered paper into high-quality cellulose insulation for homes and buildings.

3. PRODUCT DESCRIPTION

IGLOO Cellulose insulation is made from recovered sorted paper and inorganic flame-retardant minerals. The fibers are designed for installation via blown-application in attics, walls and ceilings. The product is used for building thermal and acoustic insulation.





Figure 1: IGLOO Cellulose

3.1 PRODUCT SPECIFICATION

IGLOO Cellulose insulation is manufactured using recovered sorted paper. A mineral treatment is incorporated during the manufacturing process to reduce flame spread. IGLOO Cellulose is a thermal insulation cellulose product. The SKU code of the product is 2736900100. The Construction Specifications Institute (CSI) Master Format code is 072123.

IGLOO Cellulose insulation complies with the standard CAN/ULC 703-09 for all technical characteristics. The insulation meets rigorous criteria related to flame spread, corrosiveness, mold development, thermal resistance, settling, humidity absorption, and chemical separation. The product complies with ASTM C 177 and ASTM C 518 standards for thermal resistance testing, as well as ASTM C1374 for the determination of installed insulation thickness, UL 2818 and CCMC 12835R for Igloo Wall System. In addition the product has been certified as Greenguard Gold in compliance with UL 2818 concerning emissions into indoor air. For more details, please refer to the technical data sheet at https://cellulose.com/pdf/cellulose_technical_data_sheet-ca-en.pdf.

3.1.1 Product Average

For the two applications, the weighted average profile of each square meter of product is calculated based on the annual 2023 production data.

3.1.2 Product-Specific EPD

This study analyses IGLOO Cellulose insulation product with the objective of conducting a life cycle assessment (LCA) to generate an environmental product declaration (EPD). The manufacturing process is conducted at a single location in Doval, Quebec, and the data collected from the Igloo company refers to the 2023 production

year. The average weight of the product per square meter of installed surface was calculated based on one unit of thermal resistance (RSI=1). Cellulose insulation can be used for different applications:

- Thermo-acoustic insulation - Blown-in insulation for wall cavities,
- Thermo-acoustic insulation - Blown-in insulation for attics

3.2 CHARACTERISTICS OF THE PRODUCT

IGLOO Cellulose insulation is composed primarily of recycled paper including paper, cardboard, and newspaper. In addition, cellulose may be recycled at the end of life. **Erreur ! Source du renvoi introuvable.** provides a comprehensive overview of the key characteristics of the product.

Table 1: Technical characteristics of IGLOO Cellulose

Technical characteristics	Value	Units
Lambda value (λ) – loose fill	0.0387	W/(m·K)
Lambda value (λ) – Dense-pack	0.0387	W/(m·K)
Thermal resistance (ASTM C 177, ASTM C 518) (R) – loose fill	3.71	ft ² ·°F.hr/BTU/in
Thermal resistance (ASTM C 177, ASTM C 518) (R) – Dense-pack	3.71	ft ² ·°F.hr/BTU/in
Open-Flammability / and Permanency (ASTM E 970)	> 0.12	W/cm ²
Smoulder resistance (CAN/ULC-S130)	< 15	%
Moisture Vapour Sorption (CAN/ULC-S703)	< 20	%
Separation of chemicals (CAN/ULC-S703)	< 1.5%	%

For detailed property and performance data of IGLOO Cellulose, please refer to the following link: [https://cellulose.com/pdf/cellulose technical data sheet-ca-en.pdf](https://cellulose.com/pdf/cellulose_technical_data_sheet-ca-en.pdf).

3.2.1 Technical Requirements

For detailed property and performance data on IGLOO Cellulose, please click [here](#).

The service life of IGLOO Cellulose corresponds to the building service life. The product meets the requirements of CAN/ULC 703-09.

3.2.2 Standards

IGLOO Cellulose adheres to the following standards for each product type:

- CAN/ULC 703-09: Standard for Cellulose Fiber Insulation for Buildings
- ASTM C1374: Determination of Installed Insulation Thickness
- UL 2818: Greenguard Gold
- CCMC 12835R: Igloo Wall System

For specific performance data on IGLOO Cellulose please refer to the following link: [https://cellulose.com/pdf/cellulose technical data sheet-ca-en.pdf](https://cellulose.com/pdf/cellulose_technical_data_sheet-ca-en.pdf) or contact Igloo Cellulose Inc. at igloo@cellulose.com.

3.3 PROPERTIES OF THE DECLARED PRODUCT AS DELIVERED

The product delivered to the installation site is the cellulose insulation (11.3 kg) packaged in plastic bags (62 g) and placed on a wooden pallet (0.035 kg/bag) and protected by an extensible polyethylene cover (16 g/bag).

3.4 MATERIAL COMPOSITION

The table below details the raw materials used in the production of IGLOO Cellulose insulation.



Table 2: Composition of IGLOO Cellulose insulation

Material	Mass
Waste paper	80%-85%
Boric acid	10%-15%
Additives	0%-2%
Water	0%-3%

3.5 MANUFACTURING

The production plant is located in Dorval, Quebec. The cellulose is produced in a continuous flow. The recycled paper is sorted, mixed, and loaded onto a conveyor. It is then crushed in a shredder, passed under a separator, and moved into a refiner. During this process, flame retardant and anti-dust additives are added to the fibers. The finished product is then packed, palletized, wrapped and ready for shipment. The figure below shows the flow diagram of IGLOO Cellulose’s manufacturing process. The electricity mix for manufacturing is the Quebec grid mix from Ecoinvent 3.9.1.[9] During the process, material losses are reintroduced in the production process.

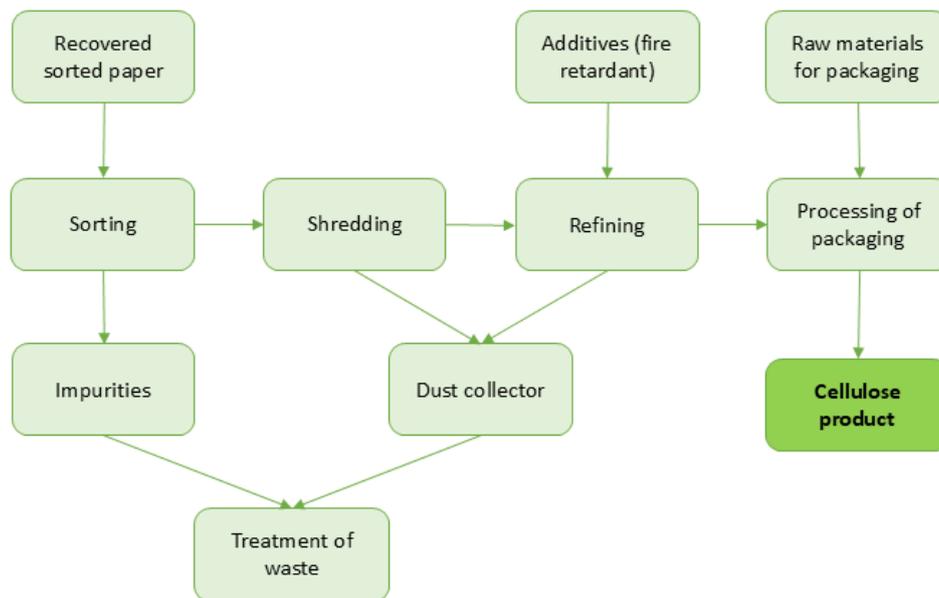


Figure 2: Manufacturing chart (A3) of IGLOO Cellulose

3.6 PACKAGING

The insulation product is delivered in polyethylene bags, which are placed on a wood pallet and wrapped with a polyethylene hood.

3.7 TRANSPORTATION

Following its production, IGLOO Cellulose is distributed in Canada and in the US. The weighted average distance is 154 km with respectively 148 km and 298 km as weighted average distance for Canada and for the US. The product is transported by truck and truck-trailer.

3.8 INSTALLATION

This EPD provides results based on the functional unit as defined for IGLOO Cellulose for each application:



- Loose fill application (attics)
- Dense-pack application (wall)

IGLOO Cellulose is installed in wall cavities, ceilings and attics using a blowing machine with pipes and through long flexible tubes. These tubes connect the blower to the area requiring insulation. Both applications follow the same installation scenario.

According to information provided by fitters, the estimated installation waste is 0.01% of the product weight.

The manufacturer's installation instructions should be followed. During the installation process, personal protective equipment (dust masks or respirators, ear plugs and safety glasses) should be worn to protect the installer's respiratory system, ears and eyes from excessive exposure to dust. In addition, the use of knee pads and rubber gloves is recommended.

3.9 USE

Once installed, the product does not require any maintenance, repair, or replacement.

3.10 REFERENCE SERVICE LIFE

As cellulose insulation is expected to last as long as the building itself, the reference service life of IGLOO Cellulose is assumed as equal to the estimated service life (ESL) of the building. According to the UL Environment PCR, Part A[5], the ESL is assumed to be 75 years. The product must be installed in accordance with the manufacturer's instructions.

3.11 END-OF-LIFE

Although the insulation product can be fully recycled at the end of the life cycle, there is no current collection program to recover and recycle cellulose insulation when buildings are deconstructed. Therefore, when the building reaches the end of its life cycle, it is assumed that the product is treated with the other demolition waste and sent to the landfill site. This results in a 100% landfill scenario.

4. METHODOLOGY USED FOR THE LIFE CYCLE ASSESSMENT

4.1 FUNCTIONAL UNIT

The LCA results indicate the life cycle environmental impacts associated with the mass of insulation product necessary to achieve the functional unit. The latter is based on the thermal resistance of the insulation product, as specified in the PCR Part B[7].

For the purpose of this study, the functional unit (FU) has been established as 1 m² of installed cellulose insulation material with a thickness that will provide an average thermal resistance RSI = 1 m²K/W. The product's expected building service life is 75 years, the packaging is included in this calculation.)

This EPD provides results based on the functional unit as defined for IGLOO Cellulose for each application:

- Loose fill application (attics)
- Dense-pack application (wall)

The functional Unit of each application is detailed in Table 3.



Table 3: Functional Unit of studied products, including mass per m² of cellulose insulation and average thicknesses

Items	Value		Unit
Functional Unit	1 m ² of installed insulation material with a thickness that gives an average thermal resistance RSI = 1 m ² K/W and with a building service life of 75 years (packaging included).		
Uses	Blow-in insulation in attics (loose fill)	Blow-in insulation in cavities (wall) (dense-pack)	
Mass to achieve the FU	1.104 ¹	1.86	kg
Thickness to achieve the FU	0.0433	0.0387	m
Thermal resistance (RSI)	1	1	m ² K/W
Thermal conductivity	0.0387	0.0387	W/(m.K)
Density	25.5	48	kg/m ³

4.2 SYSTEM BOUNDARIES

The whole life cycle of the product is considered in the scope of this report (cradle-to-grave). The system boundaries correspond to the diagram in figure 3, aligning with the requirements of the PCR part B[7]. Within this standard, the life cycle stages and processes are structured in a modular system (module A-C4) as follows:

- Module A1-3 = Production stage with raw material supply (A1), transport of raw materials (A2) and manufacturing (A3),
- Module A4–5 = Construction stage with transport to the construction site (A4) and construction/installation processes (A5)
- Module B1-7 = Use stage with use (B1), maintenance (B2), repair (B3), replacement (B4), refurbishment (B5), operational energy use (B6) and operational water use (B7)
- Module C1-4 = End-of-Life (EOL) with de-construction/demolition (C1), transport (C2), waste processing (C3) and disposal (C4)

The system boundaries stop at the end of the disposal stage (module C4), defined as the end of the product life cycle.

Table 4: System boundaries

Production stage			Construction stage		Use stage							End-of-life stage				Benefits and loads beyond the system boundaries
Extraction and upstream production	Transport	Manufacturing	Transport from gate to site	Assembly / Installation	Use	Maintenance	Repair	Replacement	Refurbishing	Operational energy use	Operational water use	Deconstruction	Transport	Waste treatment	Disposal	Reuse - recycling
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	MND

MND = Module not declared

¹ The value of mass per surface unit indicated in **Erreur ! Source du renvoi introuvable.** includes the settling percentage.

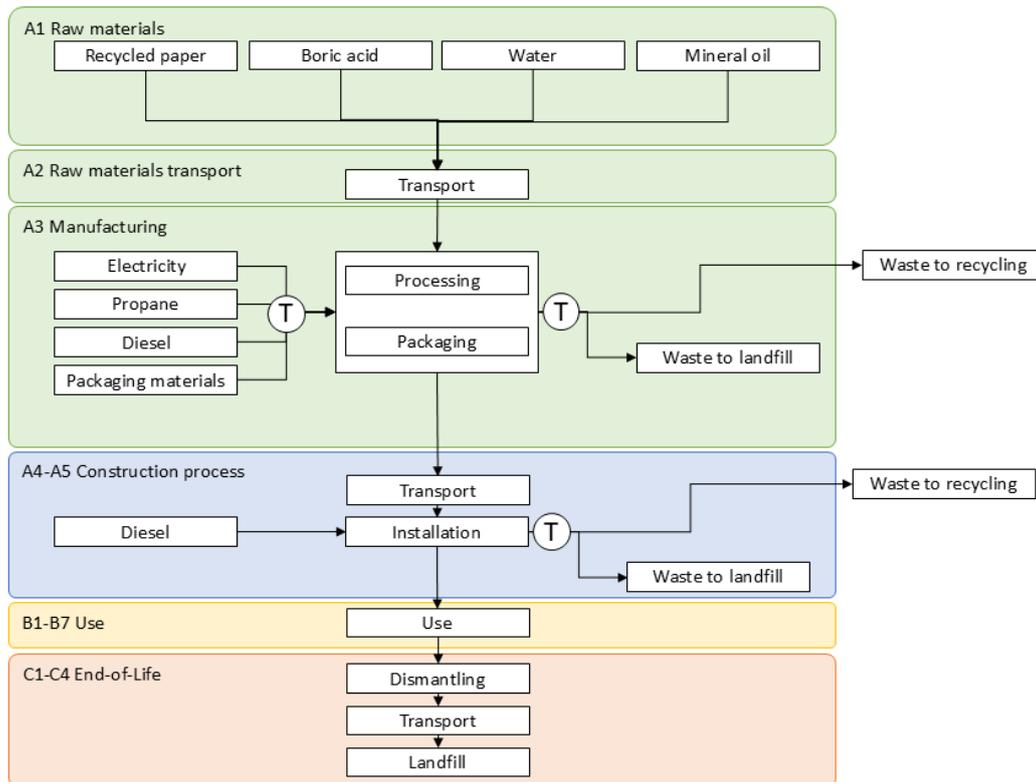


Figure 3: Flow Diagram of IGLOO Cellulose's life cycle

4.3 GEOGRAPHICAL SCOPE

The product assessed in this LCA study is manufactured in the province Quebec (Canada) and installed in both Canada and the United States.

4.4 ASSUMPTIONS

In instances where data is incomplete or missing, assumptions must be made. In the LCA the following assumptions were applied:

- A4: Some small deliveries directly on-site were not evaluated. This represents around 2% of the delivered products. The weighted average distance of the other deliveries (154 km) was considered for these small direct on-site deliveries.
- C2: The transport distance of the waste product to the landfill site is considered 50km based on expert judgement.

4.5 CUT-OFF CRITERIA

According to the UL Environment PCR – Part A[5], if a mass flow or energy flow represents less than 1% of the system's cumulative mass or energy flow, it may be excluded from system boundaries. However, these flows should not have a relevant environmental impact. Also, at least 95% of the energy usage and mass flow shall be included.

In the present study, no primary data (input material, energy consumption) were excluded from the system boundaries.

In this study, the model excluded data on the construction, maintenance or dismantling of capital assets, daily transport of the employees, office work, business trips and other activities from Igloo Cellulose Inc. employees. The model exclusively considers the processes associated with infrastructures already included in the *Ecoinvent* unit processes.

No known flows are deliberately excluded from this EPD.

4.6 ALLOCATION

No co-product allocation occurs in the product foreground system. Also no multi-input allocation occurs in the product system. The allocations from the *Ecoinvent* cut-off background database are used. This is in compliance with ISO 21930[4].

4.7 REFERENCE PERIOD

Primary data were collected to be representative of the full year 2023.

4.8 DATA SOURCES AND QUALITY

Inventory data was collected from the IGLOO Cellulose manufacturing plant located at 2999 Miller, Dorval, Quebec (Canada), using a life cycle inventory questionnaire. All data collected at the Igloo plant (primary data) was used in the analysis. The secondary data was sourced from *Ecoinvent* 3.9.1[9].

Table 5: Data quality assessment

Data Quality Parameter	Data Quality Discussion
Time-related Coverage: Age of data and the minimum length of time over which data is collected	Primary data were collected by Igloo Cellulose Inc. over the full year 2023. Secondary data comes from <i>Ecoinvent</i> 3.9.1 [9] released in December 2022. As none of the used datasets were categorized as “obsolete”, so it is concluded that all the datasets used are representative for the release date (December 2022). It is considered that the age requirement for the datasets (10 years) is met.
Geographical Coverage: Geographical area from which data for unit processes is collected to satisfy the goal of the study	The manufacturing site is located in Dorval, Quebec; therefore, electricity consumption is based on the Quebec grid mix. The geographical correlation of the material supply and the selected datasets are representative of each specific area or a larger area. For example, some chemicals, as Boric acid comes from Turkey (Europe).
Technology Coverage: Specific technology or technology mix	Primary data, obtained from the manufacturer, are representative of the current technologies and materials used by the company.
Precision: Measure of the variability of the data values for each data expressed	Primary data were based on measured and calculated data from Igloo Cellulose Inc., the manufacturing plant. The facility data were collected for the reference year 2023, and several sources were used to compare collected values and ensure precision. The data precision is considered to be of high quality for all measured and calculated data.
Completeness: Percentage of flow that is measured or estimated	All relevant process steps within the system boundary were considered. The primary data provided for cellulose insulation manufacturing was benchmarked with data from previous models which have undergone third party review.
Representativeness: Qualitative assessment of the degree to which the data set reflects the true population of interest	The data sets used in the underlying LCA study were selected based on the most appropriate temporal, geographical, and technological representation of the actual processes and technology. These data sets reflect average processes from multiple sources, and thus generally represent the actual technology utilized to produce the materials. However, the extent to which

	secondary data sets deviate from the specific system being studied is often unknown.
Consistency: Qualitative assessment of whether the study methodology is applied uniformly to the various components of the analysis	In order to ensure consistency, only primary data of the same level of detail and equivalent time interval (i.e., one calendar year) were used, and allocation was conducted similarly for all data categories and life cycle stages. All background data were sourced from the Ecoinvent 3.9.1 [9] database, with selection of the most appropriate geography.
Reproducibility: Qualitative assessment of the extent to which information about the methodology and data values would allow an independent practitioner to reproduce the results reported in the study	The study can be fully reproduced using the information provided in the underlying LCA report. However, due to the confidentiality of the data values, specific details were omitted from this public EPD, which may limit reproducibility by the public.
Sources of the Data: Description of all primary and secondary data sources	Manufacturing data was collected from IGLOO Cellulose manufacturing site located at 2999 Miller, Dorval Quebec (Canada), for the 2023 production year. The data included the following: total production mass of produced product at the manufacturing plant and relevant flows; raw materials entering the production process; material losses; transport mode and distance of materials; energy consumption, water consumption, emissions to the environment at the manufacturing plant, waste treatment, packaging material, product distribution. Secondary data come from Ecoinvent 3.9.1 [9]
Uncertainty of the Information: Uncertainty related to data, models, and assumptions	Because the quality of secondary data is not as good as primary data, the use of secondary data becomes an inherent limitation of the study. Secondary data may cover various technologies, time periods, and geographical locations. Because hundreds of data sets are linked together and it is often unknown how much the secondary data used deviates from the specific system being studied, quantifying data uncertainty for the complete system becomes very challenging. As a result, it is not possible to provide a reliable quantified assessment of overall data uncertainty.

4.9 SOFTWARE

SimaPro version 9.5.0.0[10] (July 2023) was used when calculating the environmental impact categories, and environmental data released in October 2022 from the Ecoinvent database, version 3.9.1, was used.

5. LCA SCENARIOS

5.1 TRANSPORT TO THE CONSTRUCTION SITE (A4)

Table 6: Distribution scenario

Parameter	Value	Unit
Transport type 1: Truck		
Fuel type	Diesel	-
Fuel quantity	18.4	L/100 km
Vehicle type	Transport truck 16-32t	-
Weighted average transport distance	18.5	km
Average payload	5.79	t
Gross density of transported product (in packaging)	147	kg/m ³
Transport type 2: Truck-trailer		
Fuel type	Diesel	-



Fuel quantity	26.0	L/100 km
Vehicle type	Transport truck >32t	-
Weighted average transport distance	135.7	km
Average payload	15.96	t
Gross density of transported product (in packaging)	147	kg/m ³

5.2 INSTALLATION (A5)

Table 7: Installation scenario

Parameter	Value	Unit
Electricity consumption per kg of installed product	0	kWh/kg
Ancillary materials per kg of installed product	0	kg/kg
Water consumption per kg of installed product	0	L/kg
Diesel consumption per kg of installed product	0.00283	L/kg
Product loss	0.01	%
Packaging waste per kg of installed product	0.019	kg/kg
Emissions to air, soil and water per kg of installed product	0	kg/kg
Volatile organic compound content per kg of installed product	0	mg/m ³

Table 8: Packaging and installation losses EoL scenario

Parameter	Loose fill application	Dense-pack application	Unit
Transport			
Transport to landfill	50		km
Transport to recycling	150		km
Vehicle type	Truck		-
Wooden pallet			
Landfill	3		%
Incineration	0		%
Recycling	97		%
Biogenic carbon content	8,62E-04	1,44E-03	kg CO ₂ eq/FU
PE film (bags and hood)			
Landfill	22		%
Incineration	0		%
Recycling	78		%
Installation losses			
Landfill	100		%
Incineration	0		%
Recycling	0		%

5.3 REFERENCE SERVICE LIFE

Table 9: Reference service life scenario

Parameter	Value
Reference service life	75 years
Declared product properties	-
Design application parameters	Installation as per manufacturer's recommendations

An assumed quality of work, when installed in accordance with the manufacturer's instructions	The insulation product meets the specified R-value.
Outdoor environment	Not applicable
Indoor environment	Normal building operating conditions
Use conditions	Not applicable
Maintenance	No maintenance required

5.4 USE (B)

Once installed, the insulation product requires no maintenance, repair, or replacement. During its service life, it does not release any emissions to the air. Therefore, no impacts are considered in this module.

5.5 END-OF-LIFE (C1-C4)

Table 10: End-of-Life scenario

Parameter		Loose fill application	Dense-pack application	Unit
Dismantling scenario		Removed manually		
Transport distance		50		km
Vehicle type		Truck		
Collection process	Collected separately	0	0	kg/FU
	Collected with mixed construction waste	1.104	1.86	kg/FU
Recovery	Reuse	0	0	kg/FU
	Recycling	0	0	kg/FU
	Incineration	0	0	kg/FU
	Incineration with energy recovery	0	0	kg/FU
Disposal	Landfill	1.104	1.86	kg/FU
Biogenic carbon emissions (excluding packaging)		2.76E-01	4.60E-01	kg CO ₂ eq/FU

6. ENVIRONMENTAL IMPACTS

6.1 LCA RESULTS

The life cycle impact assessment results are reported for 1 m² of insulation product, giving an average thermal resistance of RSI = 1 m²K/W. The results were calculated using IPCC (2013) V1.03[12] methodology for GWP indicators, CML Baseline V3.09[13] for ADP Fossil and TRACI 2.1[11] methods for the other indicators. They are reported for each declared life cycle module.

It shall be reiterated at this point that the reported impact categories represent potential impacts, i.e., they are approximations of environmental impacts that could occur if the emissions would (a) follow the underlying impact pathway and (b) meet certain conditions in the receiving environment while doing so. In addition, the inventory only captures that fraction of the total environmental load corresponding to the chosen functional unit (relative approach).

Therefore, LCIA results are only relative expressions and do not predict actual impacts, the exceeding of thresholds, safety margins, or risks. The impact assessment and the interpretation of this study are performed according to the PCR part A[5]. The inventory analysis results are linked to specific environmental damage categories (e.g., global warming, acidification, etc.). The overall impact assessment results were calculated excluding long-term emissions (emissions occurring after 100 years).

These six impact categories are considered mature enough to be included in Type III environmental declarations. Other categories are being developed and defined, and LCA should continue advancing their development. However, the EPD users shall not use additional measures for comparative purposes.

Table 11: Life Cycle Impact Assessment Results for IGLOO Cellulose in loose fill application

Indicators	Unit	Production			Construction		Use							End-of-Life				Total
		A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	
ODP	kg CFC-11 eq	4.25E-09	5.67E-10	3.53E-10	4.45E-10	1.63E-10	0	0	0	0	0	0	0	0	1.74E-10	0	4.41E-10	6.39E-09
GWP total	kg CO2 eq	-1.17E+00	3.40E-02	-1.03E-01	2.62E-02	1.16E-02	0	0	0	0	0	0	0	0	1.06E-02	0	3.74E-01	-8.12E-01
GWP fossil	kg CO2 eq	1.89E-01	3.40E-02	3.84E-02	2.62E-02	1.04E-02	0	0	0	0	0	0	0	0	1.06E-02	0	3.79E-02	3.47E-01
GWP biogenic	kg CO2 eq	-1.35E+00	0.00E+00	-1.41E-01	0.00E+00	1.15E-03	0	0	0	0	0	0	0	0	0.00E+00	0	3.36E-01	-1.16E+00
SFP	kg O3 eq	2.02E-02	9.38E-03	1.98E-03	1.90E-03	1.34E-03	0	0	0	0	0	0	0	0	7.52E-04	0	3.10E-03	3.87E-02
AP	kg SO2 eq	2.81E-03	4.91E-04	1.24E-04	8.32E-05	4.67E-05	0	0	0	0	0	0	0	0	3.32E-05	0	2.81E-04	3.87E-03
EP	kg N eq	1.16E-04	2.23E-05	2.19E-05	8.21E-06	3.91E-06	0	0	0	0	0	0	0	0	3.28E-06	0	1.75E-03	1.93E-03
ADP fossil	MJ	2.56E+00	4.49E-01	7.14E-01	3.73E-01	1.31E-01	0	0	0	0	0	0	0	0	1.47E-01	0	3.70E-01	4.74E+00



Table 12: Life Cycle Impact Assessment Results for IGLOO Cellulose in dense-pack application

Indicators	Unit	Production			Construction		Use							End-of-Life				Total
		A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	
ODP	kg CFC-11 eq	7.08E-09	9.45E-10	5.88E-10	7.42E-10	2.71E-10	0	0	0	0	0	0	0	0	2.91E-10	0	7.34E-10	1.07E-08
GWP total	kg CO2 eq	-1.94E+00	5.67E-02	-1.71E-01	4.36E-02	1.93E-02	0	0	0	0	0	0	0	0	1.77E-02	0	6.23E-01	-1.35E+00
GWP fossil	kg CO2 eq	3.15E-01	5.67E-02	6.39E-02	4.36E-02	1.73E-02	0	0	0	0	0	0	0	0	1.77E-02	0	6.32E-02	5.78E-01
GWP biogenic	kg CO2 eq	-2.26E+00	0.00E+00	-2.35E-01	0.00E+00	1.92E-03	0	0	0	0	0	0	0	0	0.00E+00	0	5.59E-01	-1.93E+00
SFP	kg O3 eq	3.37E-02	1.56E-02	3.30E-03	3.17E-03	2.24E-03	0	0	0	0	0	0	0	0	1.25E-03	0	5.17E-03	6.44E-02
AP	kg SO2 eq	4.68E-03	8.19E-04	2.06E-04	1.39E-04	7.78E-05	0	0	0	0	0	0	0	0	5.53E-05	0	4.69E-04	6.45E-03
EP	kg N eq	1.93E-04	3.72E-05	3.65E-05	1.37E-05	6.51E-06	0	0	0	0	0	0	0	0	5.47E-06	0	2.92E-03	3.21E-03
ADP fossil	MJ	4.26E+00	7.48E-01	1.19E+00	6.21E-01	2.19E-01	0	0	0	0	0	0	0	0	2.46E-01	0	6.16E-01	7.90E+00

ODP = Ozone depletion potential ; GWP total = Global warming potential, total ; GWP fossil = Global warming potential, fossil ; GWP biogenic = Global warming potential, biogenic ; SFP = Smog Formation Potential ; AP = Acidification potential ; EP = Eutrophication potential ; ADP fossil = Abiotic Resource Depletion Potential of Non-renewable (fossil) energy resources



6.2 RESOURCE USE

Table 13: Life Cycle Inventory Results in resource use for IGLOO Cellulose in loose fill application

Indicators	Unit	Production			Construction		Use							End-of-Life				Total	
		A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4		
RPRE	MJ	2.44E-01	4.56E-03	5.49E-01	4.78E-03	5.38E-04	0	0	0	0	0	0	0	0	0	1.90E-03	0	2.06E-02	8.25E-01
RPRM	MJ	1.33E+01	0.00E+00	1.14E+00	0.00E+00	-1.11E+00	0	0	0	0	0	0	0	0	0	0.00E+00	0	0.00E+00	1.34E+01
RPRT	MJ	1.36E+01	4.56E-03	1.69E+00	4.78E-03	-1.11E+00	0	0	0	0	0	0	0	0	0	1.90E-03	0	2.06E-02	1.42E+01
NRPRE	MJ	3.34E+00	4.61E-01	8.46E-01	3.89E-01	1.31E-01	0	0	0	0	0	0	0	0	0	1.54E-01	0	4.41E-01	5.76E+00
NRPRM	MJ	0.00E+00	0.00E+00	4.72E-01	0.00E+00	-3.68E-01	0	0	0	0	0	0	0	0	0	0.00E+00	0	0.00E+00	1.04E-01
NRPRT	MJ	3.34E+00	4.61E-01	1.32E+00	3.89E-01	-2.37E-01	0	0	0	0	0	0	0	0	0	1.54E-01	0	4.41E-01	5.86E+00
SM	kg	9.15E-01	0.00E+00	8.46E-02	0.00E+00	0.00E+00	0	0	0	0	0	0	0	0	0	0.00E+00	0	0.00E+00	1.00E+00
RSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0	0	0	0	0	0	0	0	0	0.00E+00	0	0.00E+00	0.00E+00
NRSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0	0	0	0	0	0	0	0	0	0.00E+00	0	0.00E+00	0.00E+00
RE	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0	0	0	0	0	0	0	0	0	0.00E+00	0	0.00E+00	0.00E+00
FW	m3	4.42E-03	4.97E-05	2.12E-04	5.32E-05	8.65E-06	0	0	0	0	0	0	0	0	0	1.89E-05	0	3.37E-04	5.10E-03

Table 14: Life Cycle Inventory Results in resource use for IGLOO Cellulose in dense-pack application

Indicators	Unit	Production			Construction		Use							End-of-Life				Total	
		A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4		
RPRE	MJ	4.07E-01	7.60E-03	9.14E-01	7.97E-03	8.96E-04	0	0	0	0	0	0	0	0	0	3.16E-03	0	3.44E-02	1.38E+00
RPRM	MJ	2.22E+01	0.00E+00	1.90E+00	0.00E+00	-1.85E+00	0	0	0	0	0	0	0	0	0	0.00E+00	0	0.00E+00	2.23E+01
RPRT	MJ	2.26E+01	7.60E-03	2.82E+00	7.97E-03	-1.84E+00	0	0	0	0	0	0	0	0	0	3.16E-03	0	3.44E-02	2.37E+01
NRPRE	MJ	5.56E+00	7.68E-01	1.41E+00	6.48E-01	2.18E-01	0	0	0	0	0	0	0	0	0	2.56E-01	0	7.35E-01	9.59E+00
NRPRM	MJ	0.00E+00	0.00E+00	7.87E-01	0.00E+00	-6.14E-01	0	0	0	0	0	0	0	0	0	0.00E+00	0	0.00E+00	1.73E-01
NRPRT	MJ	5.56E+00	7.68E-01	2.20E+00	6.48E-01	-3.95E-01	0	0	0	0	0	0	0	0	0	2.56E-01	0	7.35E-01	9.77E+00
SM	kg	1.53E+00	0.00E+00	1.41E-01	0.00E+00	0.00E+00	0	0	0	0	0	0	0	0	0	0.00E+00	0	0.00E+00	1.67E+00
RSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0	0	0	0	0	0	0	0	0	0.00E+00	0	0.00E+00	0.00E+00
NRSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0	0	0	0	0	0	0	0	0	0.00E+00	0	0.00E+00	0.00E+00
RE	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0	0	0	0	0	0	0	0	0	0.00E+00	0	0.00E+00	0.00E+00
FW	m3	7.37E-03	8.28E-05	3.53E-04	8.86E-05	1.44E-05	0	0	0	0	0	0	0	0	0	3.15E-05	0	5.62E-04	8.50E-03

RPRE = Renewable primary resources used as energy carrier (fuel) ; RPRM = Renewable primary resources with energy content used as material ; RPRT = Total use of renewable primary energy resources ; NRPRE = Non-renewable primary resources used as an energy carrier (fuel) ; NRPRM = Non-renewable primary resources with energy content used as material ; NRPRT = Total use of non-renewable primary energy resources ; SM = Secondary material ; RSF = Renewable secondary fuels ; NRSF = Non-renewable secondary fuels ; RE = Recovered energy ; FW = Net use of fresh water resources



6.3 WASTE CATEGORIES AND OUTPUT FLOWS

Table 15: Life Cycle Inventory Results in waste categories and output flows for IGLOO Cellulose in loose fill application

Indicators	Unit	Production			Construction		Use							End-of-Life			Total		
		A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3		C4	
HWD	kg	5.99E-03	4.93E-04	1.10E-03	4.35E-04	5.19E-05	0	0	0	0	0	0	0	0	0	1.75E-04	0	8.02E-04	9.05E-03
NHWD	kg	5.40E-01	2.45E-02	2.33E-02	3.37E-02	2.97E-03	0	0	0	0	0	0	0	0	0	8.67E-03	0	1.12E+00	1.75E+00
HLRW	m3	2.51E-10	4.11E-12	1.09E-10	4.41E-12	5.41E-13	0	0	0	0	0	0	0	0	0	1.66E-12	0	2.04E-11	3.91E-10
ILLRW	m3	1.76E-09	2.15E-11	1.85E-10	2.31E-11	2.83E-12	0	0	0	0	0	0	0	0	0	8.51E-12	0	1.12E-10	2.11E-09
CRU	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0	0	0	0	0	0	0	0	0	0.00E+00	0	0.00E+00	0.00E+00
MR	kg	0.00E+00	0.00E+00	1.33E-03	0.00E+00	9.10E-02	0	0	0	0	0	0	0	0	0	0.00E+00	0	0.00E+00	9.24E-02
MER	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0	0	0	0	0	0	0	0	0	0.00E+00	0	0.00E+00	0.00E+00
EE	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0	0	0	0	0	0	0	0	0	0.00E+00	0	0.00E+00	0.00E+00

Table 16: Life Cycle Inventory Results in waste categories and output flows for IGLOO Cellulose in dense-pack application

Indicators	Unit	Production			Construction		Use							End-of-Life			Total		
		A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3		C4	
HWD	kg	9.98E-03	8.22E-04	1.84E-03	7.25E-04	8.65E-05	0	0	0	0	0	0	0	0	0	2.91E-04	0	1.34E-03	1.51E-02
NHWD	kg	9.00E-01	4.09E-02	3.88E-02	5.62E-02	4.95E-03	0	0	0	0	0	0	0	0	0	1.44E-02	0	1.86E+00	2.92E+00
HLRW	m3	4.18E-10	6.85E-12	1.82E-10	7.36E-12	9.01E-13	0	0	0	0	0	0	0	0	0	2.76E-12	0	3.40E-11	6.52E-10
ILLRW	m3	2.93E-09	3.59E-11	3.09E-10	3.85E-11	4.72E-12	0	0	0	0	0	0	0	0	0	1.42E-11	0	1.87E-10	3.52E-09
CRU	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0	0	0	0	0	0	0	0	0	0.00E+00	0	0.00E+00	0.00E+00
MR	kg	0.00E+00	0.00E+00	2.22E-03	0.00E+00	1.52E-01	0	0	0	0	0	0	0	0	0	0.00E+00	0	0.00E+00	1.54E-01
MER	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0	0	0	0	0	0	0	0	0	0.00E+00	0	0.00E+00	0.00E+00
EE	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0	0	0	0	0	0	0	0	0	0.00E+00	0	0.00E+00	0.00E+00

HWD = Hazardous waste disposed ; NHWD = Non-hazardous waste disposed ; HLRW = High-level radioactive waste, conditioned, to final repository ; ILLRW = Intermediate- and low-level radioactive waste, conditioned, to final repository ; CRU = Components for re-use ; MR = Materials for recycling ; MER = Materials for energy recovery ; EE = Recovered energy exported from the product system



6.4 BIOGENIC CARBON

Table 17: BCR and BCE from IGLOO Cellulose and its packaging for 1 FU as loose fill application in attics

Category	Module	BCR (kg CO ₂)	BCE (kg CO ₂)	Comments
Product	A1	-1.35E+00	0.00E+00	100% landfilled
	A5	-1.50E-04	1.08E-04	
	C4	0.00E+00	2.76E-01	
Wood Packaging	A3	1.41E-01	0.00E+00	3% landfilled
	A5	0.00E+00	8.62E-04	

Table 18: BCR and BCE from IGLOO Cellulose and its packaging for 1 FU as dense-pack application in walls

Category	Module	BCR (kg CO ₂)	BCE (kg CO ₂)	Comments
Product	A1	-2.26E+00	0.00E+00	100% landfilled
	A5	-4.15E-04	1.80E-04	
	C4	0.00E+00	4.60E-01	
Wood Packaging	A3	2.35E-01	0.00E+00	3% landfilled
	A5	0.00E+00	1.44E-03	

BCR = Biogenic Carbon Removal

BCE = Biogenic Carbon Emissions

7. LCA INTERPRETATION

The raw materials (A1) contribute to the largest share of the environmental impacts for all impact categories except Eutrophication, where product's landfill is the most significant module. Boric acid is the most contributing raw material, representing over 90% of the impacts over A1 on all the impact categories. When biogenic carbon is included in the calculation, the product's impact on global warming potential significantly decreases as biogenic carbon is stored in the product. As the product's end-of-life is 100% landfill, only 20% of the biogenic carbon is re-emitted.

Fossil carbon dioxide emissions are the primary contributor to global warming, and crude oil is the main driver to abiotic depletion.

Some assumptions were made for this study that may affect the results. The most important assumptions are:

- The end-of-life scenario is based on studies and regional averages and may not reflect the actual end-of-life of the product. Results may differ significantly depending on the actual waste management (e.g. if it's incinerated or recycled instead of landfilled).
- The paper degradation in landfills (10% after 100 years) is based on a study on wooden materials and wood-based products. However, the association of paper with flame retardants may affect the degradation of the product.
- Methane flaming at the landfill site is also based on regional averages and may not correspond to the real end-of-life of the product. Methane has significant impacts on Global Warming. Therefore, the flaming of its emissions greatly affects the product's impacts on this indicator.
- The load capacity and empty-return rate for transportation follow those of theecoinvent dataset. However, these parameters are averages that may not reflect the reality of the product, and may significantly affect the results for modules A2 and A4.

8. ADDITIONAL ENVIRONMENTAL INFORMATION

8.1 ENVIRONMENTAL ACTIVITIES AND CERTIFICATIONS

In addition, IGLOO Cellulose is certified Greenguard Gold by UL Environment.

8.2 ENVIRONMENT AND HEALTH DURING MANUFACTURING

IGLOO Cellulose Inc. is fully committed to the diligent protection of both the environment and the health and safety of its employees and the employees of its customers. The manufacturing process includes state-of-the-art environmental control equipment and the employees are equipped with the highest quality personal protective equipment. IGLOO Cellulose Inc. research and development process strives to create products that have a sustainable impact on buildings and their occupants.

8.3 ENERGY SAVINGS DURING USE

The use of insulation material reduces the energy consumption of a building throughout its life cycle, thereby reducing its environmental impact. In the case of this LCA, the environmental benefits provided by IGLOO Cellulose due to the reduction in energy consumption of the building have not been included in this EPD, in accordance with PCR Part B[7]. In order to assess the potential impact reductions, energy simulations could be performed, taking into account several building parameters (geometry, type of heating, etc.) to determine the resulting energy saving.

8.4 ENVIRONMENT AND HEALTH DURING INSTALLATION

The manufacturer's installation instructions should be followed. During installation, personal protective equipment (dust masks or respirators, ear plugs and safety glasses) should be worn to protect the installer's respiratory system, ears and eyes from excessive exposure to sawdust. In addition, the use of knee pads and rubber gloves is recommended.

8.5 EXTRAORDINARY EFFECTS

There are no extraordinary effects to report.

8.6 DELAYED EMISSIONS

No delayed emissions shall be reported.

8.7 REGULATED HAZARDOUS SUBSTANCES

The insulation product contains only the materials listed in Table 2, these are not on the Canadian list of toxic substances.

8.8 ADDITIONAL INFORMATION ON RELEASING HAZARDOUS SUBSTANCES - INDOOR AIR QUALITY DURING USE PHASE

8.8.1 Emission of VOCs

A VOC emission test has been conducted and the product has been awarded the "Low VOC Emission Certificate # 120120-03" (Berkeley Analytical).

8.8.2 Mould and micro-organisms

The product is resistant, there is no mould growth according to ASTM C 1338-96. .

8.8.3 Emissions of dust and fibers during building use phase

The product is isolated from indoor air; therefore, it is not intended to come into contact with indoor air.

8.9 CONTRIBUTION OF PRODUCT TO COMFORT INSIDE BUILDINGS

The product is certified according the UL GREENGUARD GOLD Certification Standard and is safe for indoor use.

8.9.1 Characteristics of the product linked to the creation of hygrothermal comfort conditions in the building

The product is a thermal insulation product, as such it contributes to the hygrothermal comfort of the building.

8.9.2 Characteristics of the product linked to the acoustic comfort in the building

In addition to its hygrothermal performance, the product can contribute to the acoustic comfort of the building.

8.10 FURTHER INFORMATION

For more specific properties and performance data of IGLOO Cellulose, please visit the following link: https://cellulose.com/pdf/cellulose_technical_data_sheet-ca-en.pdf.

9. REFERENCES

- [1] ISO 14040:2006 Environmental management — Life cycle assessment — Principles and framework (Edition 2, 2006)
 - [2] ISO 14044:2006 Environmental management — Life cycle assessment — Requirements and guidelines (Edition 1, 2006)
 - [3] EN 15804:2012+A2. European Standard. Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products. October 2019
 - [4] ISO 14025:2006 Environmental labels and declarations – Type III environmental declarations – Principles and procedures. (Edition 1, 2006)
 - [5] ISO 21930:2017 : Sustainability in buildings and civil engineering works — Core rules for environmental product declarations of construction products and services
 - [6] UL Environment Standard 10010, Product Category Rules for Building-Related Products and Services Part A: Life Cycle Assessment Calculation Rules and Report Requirements version 4.0
-

- [7] Product Category Rules for Part B: Building Envelope Thermal Insulation EPD Requirements, UL 10010–1, edition 3.0, dated April 2023
 - [8] IPCC, 2006. WASTE GENERATION, COMPOSITION AND MANAGEMENT DATA, Guidelines for National Greenhouse Gas Inventories. (biogenic carbon content in paper and paperboard)
 - [9] Ecoinvent 3.9.1, December 2022
 - [10] Simapro 9.5.0.0, July 2023
 - [11] U.S. Environment Protection Agency. Tool for the Reduction and Assessment of Chemical and other environmental Impacts (TRACI) v2.1. 2012
 - [12] Intergovernmental Panel on Climate Change. IPCC 2013. 2013
 - [13] Center of Environmental Science (CML) of Leiden University. CML-IA Baseline. August 2016
-

Owner of the EPD Responsible for data, LCA and information	Igloo Cellulose Inc. 1485, route Transcanadienne Dorval (Quebec) H9V 2V3 Canada https://cellulose.com/home	
EPD Program Program operator	ASTM International 100 Barr Harbor Drive West Conshohocken, PA 19428 United States of America (USA) www.astm.org	
Author(s) of the LCA and EPD	WeLOOP 254 Rue du Bourg 59130 Lambersart France	
Identification of the project report	Environmental Product Declaration Background Report - IGLOO® Cellulose insulation	
Verification Name of the third party verifier Date of verification	ISO 14025:2006 Charles Thibodeau February 3, 2024	