BORALIFE

Treated lumber products

Environmental Product Declaration

The development of this product-specific environmental product declaration (EPD) for **Treated lumber products in Quebec, Canada** was commissioned by **Technologies Boralife Inc.** This EPD was developed in compliance with CAN/CSA-ISO 14025, ISO 14040, ISO 14044, ISO 21930 and has been verified by Jean-François Ménard, from the International Reference Centre for the Life Cycle of Products, Processes and Services (CIRAIG).

This EPD includes life cycle assessment (LCA) results for raw material supply, transport and manufacturing modules (cradle-to-gate). The LCA was performed by Groupe AGÉCO.

For more information about Technologies Boralife Inc., please go to https://boralife.ca/.

Issue date: November 11, 2022

Environmental Product Declaration

CSA Group Registered Based on ISO 14025 and Other Requirements

For more information visit csaregistries.ca/epd

9002-0081

November 2022-November 2027

This product-specific environmental product declaration (EPD) for Treated lumber products is in accordance with CAN/CSA-ISO 14040, ISO 14044, ISO 14025 and ISO 21930 standards. EPDs within the same product category but from different programs may not be comparable. This EPD reports environmental impacts based on established life cycle impact assessment methods. The reported environmental impacts are estimates, and their level of accuracy may differ for a particular product line and reported impact. LCAs do not generally address site-specific environmental issues related to resource extraction or toxic effects of products on human health. Unreported environmental impacts include (but are not limited to) factors attributable to human health, land use change and habitat destruction. Forest certification systems and government regulations address some of these issues. In this EPD, treated lumber products conforms to American Wood Protection Association (AWPA) standards; Canadian Standards Association (CSA) standards; Standards of Wood Preservation Canada (WPC). EPDs do not report product environmental performance against any benchmark.

Program operator	CSA Group 178 Rexdale Blvd, Toronto, ON, Canada M9W 1R3 www.csagroup.org
General program instructions	CSA-SDP-5-13 CSA Group program operator rules for Type III environmental product declarations (2013)
Product	Treated lumber products
Manufacturer name and address	Technologies Boralife Inc. 600, rue Cormier, Sorel-Tracy, Québec, J3R 5A3 https://boralife.ca/
Registration number	#9002-0081
Declaration product & declared unit	One cubic meter (1 m^3) of treated lumber products
Reference PCR and version number	North American Structural and Architectural Wood Products (version 2) FPInnovation, 2015 North American Pressure-treated Wood Products (version 1) ASTM International, 2016 Valid until December 2022, update scheduled
Market of applicability	North America
Date of issue (approval)	November 11, 2022
Period of validity	November 11, 2022 – November 10, 2027
EPD type	Product-specific
Dataset variability	Not applicable
EPD scope	Cradle-to-gate (A1-A3)
Year(s) of reported primary data	January 2022 – February 2022
LCA software & version number	SimaPro 9.3

LCI database(s) & version number	ecoinvent 3.8
LCIA methodology & version number	TRACI 2.1
The sub-category PCR review was conducted by:	Thomas P. Gloria (Chair, Industrial Ecology Consultant) Paul A. Cooper (Emeritus Professor, Faculty of Forestry, University of Toronto)
This declaration was independently verified in accordance with ISO 14025:2006. The ASTM International "North-American Pressure-Treated Wood Products" v1 (2016), in conformance with ISO 21930:2017, serves as the core PCR, with additional considerations from the FPInnovation "North American Structural and Architectural Wood Products" (2015).	__ Internal x External
This life cycle assessment was conducted in accordance with ISO 14044 and the reference PCR by:	Groupe AGÉCO 1995, rue Frank-Carrel, suite 219 Quebec (Quebec) G1N 4H9 www.groupeageco.ca
The life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by:	 Jean-François Ménard CIRAIG, Polytechnique Montréal 3333 rue Queen Mary, Suite 310, Montréal, QC, Canada, H3V 1A2 jean-francois.menard@polymtl.ca www.ciraig.org

Limitations

Environmental declarations from different programs (ISO 14025) may not be comparable.

Comparison of the environmental performance using EPD information shall consider all relevant information modules over the full life cycle of the products within the building.

This PCR allows EPD comparability only when the same functional requirements between products are ensured and the requirements of ISO 21930:2017 §5.5 are met. It should be noted that different LCA software and background LCI datasets may lead to differences results for upstream or downstream of the life cycle stages declared.

TECHNOLOGIES BORALIFE INC. Environmental Product Declaration Summary Sheet

Treated lumber products

This is a summary of the product-specific environmental product declaration (EPD) describing the environmental performance of treated lumber products, treated in Quebec, Canada.

With the support of

BORALIFE | Quebec Wood Export Bureau | Forêts, Faune et Parcs Québec

EPD commissioner and owner	Period of validity	Program operator and registration number	Product Category Rule	LCA and EPD consultants
Technologies Boralife Inc.	November 11, 2022-November 10, 2027,	CSA Group 9002-0081	North American Pressure-treated Wood Products v.1 (2016)	Groupe AGÉCO

Product description

Fire-retardant or termite- and mold-prevention treated lumber products used for residential and commercial buildings as defined by CSA 080.1-15.

Declared unit

One cubic meter (1 m^3) of treated lumber produced in Canada.

Material content (% of total product mass)

Softwood lumber: 98.1%
Disodium Octaborate Tetrahydrate: 1.9%

Scope and system boundary

Cradle-to-gate: raw material supply (A1), transport (A2) and manufacturing (A3) modules.

What is a Life Cycle Assessment (LCA)?

LCA is a science-based and internationally recognized tool to evaluate the relative potential environmental and human health impacts of products and services throughout their life cycle, beginning with raw material extraction and including all aspects of transportation, production, use, and end-of-life treatment. The method is defined by the International Organization for Standardization (ISO) 14040 and 14044 standards.

Why an Environmental Product Declaration (EPD)?

Technologies Boralife Inc. is seeking to communicate its environmental performance to clients and to position its products through a rigorous and recognized approach, an EPD. By selecting products with an EPD, building projects can earn credits towards the Leadership in Energy and Environmental Design (LEED) rating system certification, among others. In the latest versions of the program (LEED v4 and v4.1), points are awarded in the Materials and Resources category.

TECHNOLOGIES BORALIFE INC. Environmental Product Declaration Summary Sheet

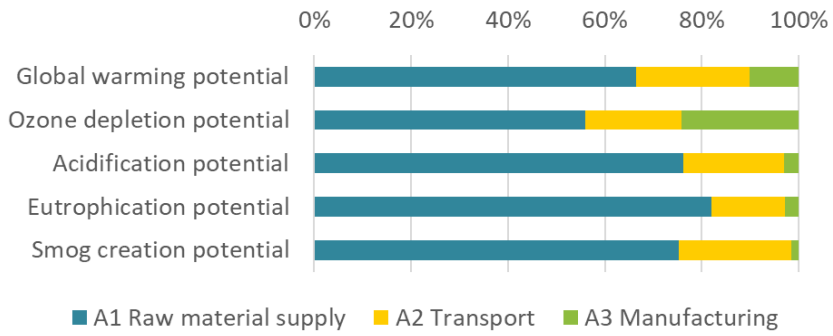
Treated lumber products

Environmental impacts

The environmental impacts of 1 cubic meter of treated lumber products over the production stage (A1 to A3 modules[1]) are summarized below for the main environmental indicators (based on life cycle impact assessment method TRACI 2.1). Refer to the LCA report or full EPD for more detailed results. Results on resource use, waste generated, and output flows are presented in the full EPD.

Indicators	Total (A1 to A3)	Results for 1 m^3 of treated lumber product		
		A1	A2	A3
Global warming potential (kg CO_2 eq.)	**9.23E+01**	6.14E+01	2.15E+01	9.41E+00
Ozone depletion potential (kg CFC-11 eq.)	**2.83E-05**	1.58E-05	5.64E-06	6.86E-06
Acidification potential (kg SO_2 eq.)	**7.87E-01**	5.9E-01	1.64E-01	2.34E-02
Eutrophication potential (kg N eq.)	**1.51E-01**	1.24E-01	2.29E-02	4.34E-03
Smog creation potential (kg O_3 eq.)	**2.04E+01**	1.54E+01	4.77E+00	3.09E-01

Relative contribution of each life cycle module to the overall environmental impacts



Data was collected from Technologies Boralife Inc. in February 2022 for manufacturing operations occurring between January 2022 and February 2022 to produce a treated lumber products batch.

Results for environmental indicators show that raw material supply module (A1) is the main contributor for all environmental impact indicators with a relative contribution of at least 55%. Then, transport module (A2) comes in second with a relative contribution between 15% and 23%. Finally, the manufacturing module (A3) varies greatly between 2% and 24%.

[1] *A1 to A3 modules cover the following processes: raw material supply (forest management, logging, roundwood transport to lumber manufacturers, sawing, kiln-drying, planning), transport of lumbers (transportation from lumber manufacturers to Boralife), and manufacturing (DOT treatment, drying, packaging, waste management).*

For more information: https://boralife.ca/

1. Description of the industry

The Quebec Wood Export Bureau (QWEB), a non-profit organization, and the Ministère des Forêts, de la Faune et des Parcs (MFFP) are currently offering a grant to manufacturers for the completion of EPDs for their products. In this context, Technologies Boralife Inc., a wood treatment company, has mandated Groupe AGÉCO – a firm specialized in life cycle assessment (LCA) and corporate responsibility – to develop one (1) product-specific (type III – third-party reviewed) environmental product declaration (EPD) on treated lumber products.

Technologies Boralife Inc. is a wood treatment company that offers a new patented treatment process using sodium borate that is simpler than traditional wood pressure treatment. The company has done extensive studies to develop this new technology in the last years. They opened for business in January 2022.

LCAs and EPDs are increasingly integrated in many buildings certification schemes, including LEED® (v4.1) which now accounts for the environmental performance of a product throughout its entire life cycle. EPDs is a tool that has become the North American standard to position products based on environmental performance.

The LCA presented in this report was conducted in accordance with the product category rule (PCR) "North American Pressure-treated Wood Products" (version 1) (ASTM International, 2016) which refers to the PCR "North American Structural and Architectural Wood Products" (version 2) (FPInnovation, 2015a). It has been conducted according to the requirements of the International Organization for Standardization (ISO) 14040, ISO 14044 and ISO 21930 standards. The PCR also covers pressure-treated wood products manufactured in accordance with current American Wood Protection Association (AWPA) standards; Canadian Standards Association (CSA) standards; Standards of Wood Preservation Canada (WPC); or an ICC Evaluation Service, LLC (ICC-ES) Evaluation Report (ESR). This product-specific type III EPD will be published under the CSA Program, hence the requirements of the CSA's program instructions (CSA Group, 2013) have been followed.

2. Description of product

2.1. Definition and product classification

The EPD covers treated wood products, which is classified under UN CPC 31, CSI 06 05 73 and NAICS 321114.

This EPD Lumber products are treated by Technologies Boralife Inc. in Quebec, Canada, with a patented treatment process. Softwood lumber is provided by different Eastern North American suppliers. The treated lumber products are then used in residential, commercial and industrial projects. It is mostly used for structural purposes.

Technologies Boralife Inc. produces two types of treated wood: "Boraflame®", which is certified fire-retardant, and "Borasmart®", which helps termite- and mold-prevention. Both products go through the same treatment process, except that "Boraflame®" is later stamped, which is considered negligible. Thus, treated lumber products will be used in this study to describe both products. More information on the products is available on Technologies Boralife Inc.'s website: https://boralife.ca/

2.2. Material content

One cubic meter of treated lumber products has an average weight of 453 kg (wet basis), excluding packaging. A description of the composition of treated lumber products is presented in Table 1. Table 2 presents the packaging weight for each cubic meter of treated lumber products.

Table 1: Materials for glued engineered softwood

Materials	Weight %	Origin of raw materials	Distance to the plant	Transport mode
Softwood lumber	98.1%	Canada	280 km	Truck
Disodium Octaborate Tetrahydrate (DOT)	1.1%	US	4,700 km	Truck

Table 2: Packaging

Packaging	Weight kg
Plastic film (LDPE)	0.28
Plastic strapping (PET)	0.05

2.3. Production of treated lumber

Treated lumber is made with sofwood lumber and DOT. Figure 1 shows the cradle-to-gate processes for manufacturing treated lumber products included in this EPD.

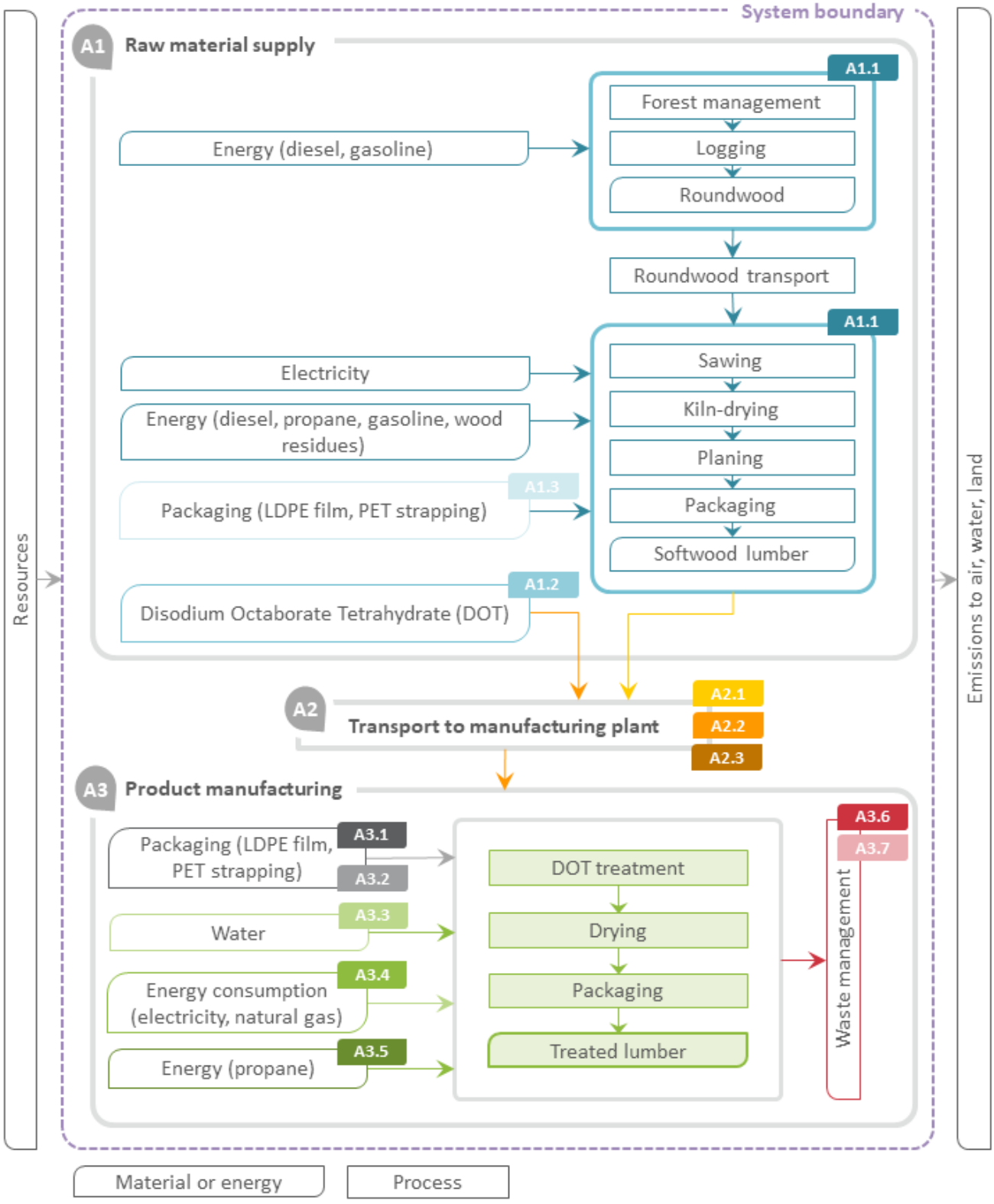


Figure 1: Process flow for all life cycle stages considered in the study

3. Scope of EPD

3.1. Declared unit

A declared unit is used in lieu of a functional unit since the life cycle does not include the construction stage, use stage, and end of life stage and the precise function of the product cannot be defined. Table 2 presents the declared unit for the assessed treated lumber products.

Table 2: Declared unit for treated lumber products, its density and its moisture content

Parameter	Value (SI units)
Declared Unit	1 cubic meter (1 m^3)
Density	398 oven-dry kg/m^3
Moisture content	12%

3.2. System boundaries

The product stage is included in the **cradle-to-gate** system boundary as shown in Table 3. All downstream stages are excluded from the LCA, and the reference service life is not specified as the study is cradle-to-gate and does not cover life cycle stages for product use.

The manufacturing module (A3) is subdivided into three distinct sub-modules to better represent the manufacturing of treated lumber products.

Table 3: Life cycle stages considered in the study

Production stage			Construc-tion stage		Use stage							End-of-life stage				
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Raw material supply	Transport to manufacturing plant	Manufacturing of treated lumber products	Transport	Construction – installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
x	x	x	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND

More precisely, the production stage includes the following modules:

- **A1 – Raw material supply – resource extraction:** Treated lumber is made 100% of FSC-certified softwood lumber (i.e., Spruce-Pine-Fir species combination (NLGA SPF)) and DOT. Softwood lumber necessitates the extraction of roundwood from forests, which is included in this module. It also includes other forestry operations such as planting, site preparation, thinning, and log loading on trucks. Roundwood is transported from forests to the lumber-manufacturing plant by truck. Ancillary materials, such as packaging are also shipped from the suppliers to the lumber-

manufacturing plant by truck. Roundwood logs go through different manufacturing processes to produce lumber, such as sawing, kiln-drying and planning. This module includes the follow flows:

  - Fuel energy (e.g., diesel, gasoline, propane, wood residues) consumption for all the steps involved in the production of lumber
  - Electricity consumption for all the steps involved in the production of lumber
  - Packaging used to package the lumber
  - Waste management of solid waste generated during the production of lumber
  - DOT production. DOT is an alkaline salt in the form of powder effective against fungi and algae, and that is flame-retardant.

- **A2 – Transport of raw materials to manufacturing plants:** Softwood lumber, packaging and DOT are shipped from the suppliers to the Technologies Boralife Inc. manufacturing plant by truck.

- **A3 – Manufacturing:** Once delivered to Technologies Boralife Inc. plant, softwood lumbers are identified and stored in the lumber yard until their use. The lumber is unpacked and treated in bundles. The bundle is placed in the treatment tank containing a heated solution of DOT and water for a period of time. After the treatment, the wood is dried in open air. The lumber is then conditioned and packed for shipment back to the suppliers. Natural gas is the main source of energy used at Technologies Boralife Inc. plant (for the treatment solution's heating). Electricity is also used at the manufacturing plant. In Quebec, the electricity grid mix is mainly composed of hydroelectricity. Propane is used for internal transportation purposes (i.e., lift moving lumber bundles in the lumber yard and treated lumber bundles in the storage yard). Waste materials such as softwood lumber packaging are either recycled or landfilled.

4. Environmental impacts

This cradle-to-gate life cycle assessment has been conducted according to ISO 14040 and 14044 standards and the Product Category Rules for North American Pressure-treated Wood Products v.1 (ASTM International, 2016) and North American Structural and Architectural Wood Products v.2 (FPInnovation, 2015a). Environmental impacts were calculated with the impact assessment method TRACI 2.1. For the calculation of total primary energy consumption indicators, the Cumulative Energy Demand method (CED, version 2.0) (Frischknecht et al., 2007) was used.

4.1. Assumptions

The main assumptions included in this LCA were related to the quantity of softwood used to manufacture 1 m³ of treated lumber products, truck capacity, distance for the transportation of raw materials and waste generated at Technologies Boralife Inc. plant.

- **Softwood log input**. The ecoinvent datasets for the production of planed lumber were used, which represent a total of 1.89 m^3 of logs allocated to the production of 1m3 of lumber.
- **Transportation**. Since the majority of raw materials and waste are transported with 53' trucks, it is assumed that all transportation was done with this type of truck. As the trucks' capacity loads vary depending on the charge they carry, the average load of 17.6 tons observed on the market was used as a generic data.

- **Distance for the transportation of raw materials**. When only data on the retailers of raw materials were available, an additional distance of 100 km was added to account for the transportation from the manufacturer or supplier of raw materials to the retailer.
- **Waste materials**. Since Technologies Boralife Inc. packages treated wood in the same manner as when it arrives at the plant, it is determined that the packaging waste is the same as the amount of packaging purchased.
- **Distance for the transportation of waste**. A distance assumption of 30 km was made between Technologies Boralife Inc. plant and waste management facilities.

4.2. Criteria for the exclusion of inputs and outputs

No known flows are deliberately excluded from this EPD. Input and output flows may have been excluded if they represented less than 1% of the cumulative mass or energy of a unit process and its environmental contribution to the total impacts was negligible. The following processes were excluded from the study due to their expected low contribution and the lack of readily available data:

- Infrastructure at the production site
- Machinery and transport vehicles within the plant
- Some negligible emissions related to the industrial process have been removed (estimated to account for less than 1%)

4.3. Data quality

Data sources

Table 4 presents the main sources of data used for this EPD. Generic data collected for the raw material supply processes and transportation of raw materials were representative of the Eastern Canadian context and used technologies.

The LCA model was developed with the SimaPro 9.3 software using ecoinvent 3.8 database, which was released in 2021 (less than 2 years). When possible, data from the Quebec context has been used. However, since most of the data within ecoinvent is of European origin and produced to represent European industrial conditions and processes, several data were adapted to enhance their representativeness of the products and contexts being examined.

Table 4: Data sources for the LCA of glued engineered softwood

Module	Main processes	Data source	Region	Year
A1	Raw material extraction and processing (roundwood), and manufacturing softwood lumber	Athena (2018) and ecoinvent 3.8	Eastern Canada	2015
A2	Transportation to Technologies Boralife Inc. plant	Technologies Boralife Inc. (2022)	Eastern Canada and US	2022
A3	Manufacturing treated lumber products	Technologies Boralife Inc. (2022)	Quebec	2022

Data quality

The overall data quality ratings show that the data used were either very good or good. This data quality assessment confirms the high reliability, representativeness (technological, geographical and time-related), completeness, and consistency of the information and data used for this study.

4.4. Allocation

A common methodological decision point in LCA occurs when the system being studied is directly connected to a past or future system (e.g. another cycle of manufacturing), or produces co-products. When systems are linked in this manner, the boundaries of the system of interest must be widened to include the adjoining system, or the impacts of the linking items must be distributed—or allocated—across the systems. ISO 14044 prioritizes the methodologies related to applying allocation.

In this particular case, there was no allocation made –other than the one by default in the ecoinvent processes– since there is no co-product at the manufacturing plant.

4.5. Life cycle impact assessment - results

Table 5 shows the results for 1 cubic meter of treater lumber over the production stage (A1 to A3).

Table 5: Results for the production of 1 m³ of treated lumber products

			Results for 1m³ of treated lumber products*		
Indicators	**Units**	**Total**	**A1**	**A2**	**A3**
Environmental indicators					
Global warming potential	kg CO_2 eq.	**9.23E+01**	6.14E+01	2.15E+01	9.41E+00
Acidification potential	kg SO_2 eq.	**2.83E-05**	1.58E-05	5.64E-06	6.86E-06
Eutrophication potential	kg N eq.	**7.87E-01**	5.99E-01	1.64E-01	2.34E-02
Smog creation potential	kg O_3 eq.	**1.51E-01**	1.24E-01	2.29E-02	4.34E-03
Ozone depletion potential	kg CFC-11 eq.	**2.04E+01**	1.54E+01	4.77E+00	3.09E-01
Non-renewable (fossil)	MJ	**1.40E+03**	8.81E+02	3.56E+02	1.59E+02
Non-renewable (nuclear)	MJ	**3.80E+01**	3.15E+01	5.05E+00	1.46E+00
Non-renewable (biomass)	MJ	**7.03E-02**	6.17E-02	6.23E-03	2.32E-03
Renewable (biomass)	MJ	**7.23E+03**	7.23E+03	9.14E-01	6.62E-01
Renewable primary energy	MJ	**2.64E+02**	2.57E+02	4.43E+00	3.14E+00
Non-renewable materials					
DOT	*kg*	**4.20E+00**	4.20E+00	0.00E+00	0.00E+00
Renewable materials					
Wood fiber	*kg*	**3.91E+02**	3.91E+02	0.00E+00	0.00E+00
Fresh water	L	**1.65E+00**	1.56E+00	4.07E-02	4.13E-02
Waste					
Hazardous waste generated	kg	**0.00E+00**	0.00E+00	0.00E+00	0.00E+00
Non-hazardous waste generated	kg	**4.09E+01**	0.00E+00	0.00E+00	4.09E+01

**Note: Results may not add up due to rounding. Energy values are higher heating values.*

4.6. Life cycle impact assessment - interpretation

Environmental impact indicators

As observed in Figure 2, the **SPF consumption** submodule (A1.1), which includes wood sourcing and lumber manufacturing, has the highest impact on all environmental indicators with a relative contribution of 38% to 70%. This is due mainly to the consumption and combustion of fossil fuels during the drying processes at the wood product manufacturing plants. **SPF transport** submodule (A2.1) is also a great contributor to all environmental indicators with a relative contribution of 14% to 22%. **DOT consumption** submodule (A1.2) relative contribution varies from 3% to 25% of the total impact between all environmental indicators.

Energy consumption submodule (A3.4) is also an important contributor to the impact on Global warming potential (10%). Energy consumption (A3.4) impacts mostly come from natural gas consumption. As Technologies Boralife Inc.'s installations are located in the province of Quebec, the electricity used for manufacturing treated lumber products has a relatively low impact as it is composed mainly of hydroelectricity. **Packaging consumption** (A1.3 and A3.1) is also a great contributor to the impact of the indicator Ozone depletion potential with a relative contribution of 14% each.

DOT transport submodule (A2.2) represents 2% or less of the relative contribution to each of the environmental indicators. The weight of DOT used to produce one cubic meter of treated wood is less than 2% compared to SPF, thus it is lighter to transport, and it doesn't have a substantial impact on the environmental indicators.

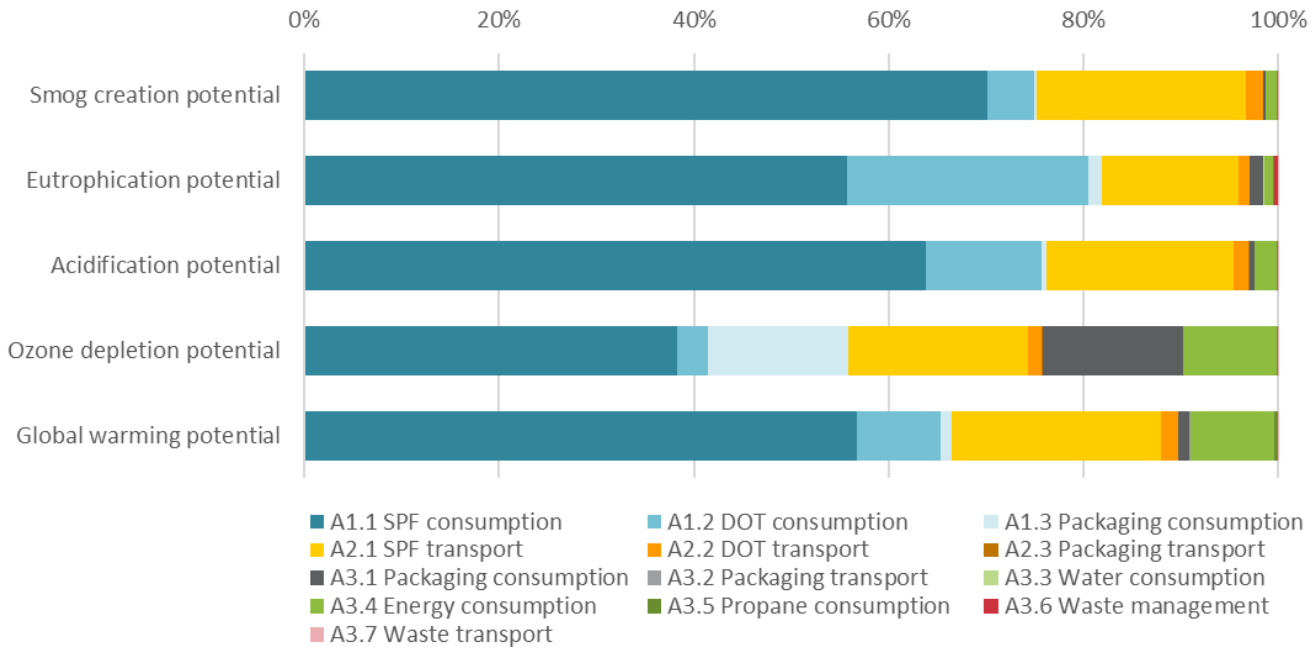


Figure 2: Relative contributions of the main processes in the production of treated lumber products

Use of resources indicators (total primary energy consumption and material resources consumption)

For **all the resources indicators**, impacts mainly come from the raw material supply module (A1) (between 63% and 100%). However, the contribution of A2 module is also significant for the indicators **Non-renewable (fossil)** with a contribution of 26%. This is mostly due to combustible consumed by transport equipment. The wood material extracted accounts for most of the **Renewable (biomass)** indicator results.

Freshwater consumption (FW) is also presented. It is mostly consumed during the raw material supply module (A1) (95%) due to electricity consumption used to produce softwood lumber from roundwood.

Hydroelectricity contributes significantly to the Fresh water indicator as more than 60% of hydroelectricity in Quebec is produced with hydroelectric dams which necessitate large artificial water reservoirs. The ecoinvent datasets assume that reservoirs contribute to an increase of the water evaporation rate.

Waste generation indicators

There is **no hazardous waste** generated over the cradle-to-gate stages. The bulk of the **non-hazardous waste** generated comes from Technologies Boralife Inc. plant and consists of plastic strapping and plastic film used to pack softwood lumber to be treated. The plastic strapping is sent to landfill while plastic film is sent for recycling.

Only the foreground processes waste flows are included (A3).

5. Additional environmental information

Carbon storage

Following the modifications to the EN 16485 methodology where biogenic CO_2 emissions are considered global warming neutral in a cradle-to-gate LCA, a carbon storage credit was calculated separately from the global warming potential indicator in this EPD. Using the B2B FP Innovations PCR Carbon Sequestration Calculator, the carbon sequestration potential at year 100 was calculated for treated lumber products. This calculator takes into account service life estimations for average end-uses and the average landfill decay rate in a North American context. Table 6 presents the detailed calculations and results for 1 m^3 of treated lumber products.

Table 6: Carbon sequestration calculation for 1 m^3 of treated lumber products

FPI carbon tool parameters	Units	Total
General parameters		
Wood mass	Oven dry kg	**395.2**
Carbon content of wood	%	**50**
Initial greenhouse gas credit		
Carbon sequestered in product at manufacturing gate	kg CO_2 eq.	**-724.5**
Greenhouse gas emissions		
Carbon dioxide emissions from recycled wood (accounted as 100% CO_2 emission)	kg CO_2	**55.5**
Carbon dioxide emissions from combusted wood waste	kg CO_2	**55.5**
Carbon dioxide emissions from aerobic landfills	kg CO_2	**39.5**
Carbon dioxide emissions from fugitive landfill gas	kg CO_2	**9.9**
Carbon dioxide emissions from combusted landfill gas	kg CO_2	**50.5**
Total carbon dioxide emissions	kg CO_2	**210.9**
Total methane emissions		
Methane emissions from fugitive landfill gas	kg CH_4	**2.9**
Net global warming potential credit		
Sequestration, net of greenhouse gas emissions	kg CO_2 eq.	**-440.3**

GLOSSARY

Acronyms

CFC-11	Trichlorofluoromethane
CH_4	Methane
CO_2	Carbon dioxide
CSA	Canadian Standards Association
DOT	Disodium Octaborate Tetrahydrate
eq.	Equivalent
FSC	Forest Stewardship Council
GHG	Greenhouse gas
GWP	Global warming potential
HHV	Higher heating value
ISO	International Organization for Standardization
kg	kilogram
kg CO_2 eq.	kilogram of carbon dioxide equivalent
km	kilometer
LCA	Life cycle assessment
LDPE	Low-density polyethylene
LEED	Leadership in Energy and Environmental Design
m^3	Cubic meter
MFFP	Ministère des Forêts, de la Faune et des Parcs
PCR	Product Category Rule
PET	Polyethylene terephtalate
QWEB	Quebec Wood Export Bureau
SO_2	Sulfur dioxide
SPF	Spruce-Pine-Fir
US EPA	United States Environmental Protection Agency

Environmental impact categories and parameters assessed

The **acidification potential** refers to the change in acidity (i.e. reduction in pH) in soil and water due to human activity. The increase in CO_2 emissions and other air pollutants (e.g. NO_x and SO_2) generated by the transportation and manufacturing sectors are the main causes of this impact category. The acidification of land and water has multiple consequences: degradation of aquatic and terrestrial ecosystems, endangering numerous species and food security. The concentration of the gases responsible for the acidification is expressed in sulfur dioxide equivalents **(kg SO_2 equivalent).**

The **eutrophication potential** measures the enrichment of an aquatic or terrestrial ecosystem due to the release of nutrients (e.g. nitrates, phosphates) resulting from natural or human activity (e.g. the discharge of wastewater into watercourses). In an aquatic environment, this activity results in the growth of algae which consume dissolved oxygen present in water when they degrade and thus affect species sensitive to the concentration of dissolved oxygen. Also, the increase in nutrients in soils makes it difficult for the terrestrial environment to manage the excess of biomass produced. The concentration of nutrients causing this impact is expressed in nitrogen equivalents **(kg N equivalent)**.

Net fresh water consumption accounts for the imbalance in the natural water cycle created by the water evaporated, consumed by a system or released to a different watershed (i.e. not its original source). This imbalance can cause water scarcity and affect biodiversity. This indicator refers to the waste of the resource rather than its pollution. Also, it does not refer to water that is used but returned to the original source (e.g. water for hydroelectric turbines, cooling or river transportation) or lost from a natural system (e.g. due to evaporation of rainwater). The quantity of fresh water consumed is expressed as a volume of water in meter cube **(L of water consumed)**.

The **global warming potential** refers to the impact of a temperature increase on the global climate patterns (e.g. severe flooding and drought events, accelerated melting of glaciers) due to the release of greenhouse gases (GHG) (e.g. carbon dioxide and methane from fossil fuel combustion). GHG emissions contribute to the increase in the absorption of radiation from the sun at the earth's surface. These emissions are expressed in units of kg of carbon dioxide equivalents **(kg CO_2 equivalent)**.

The **ozone depletion potential** indicator measures the potential of stratospheric ozone level reduction due to the release of some molecules such as refrigerants used in cooling systems (e.g. chlorofluorocarbons). When they react with ozone (O_3), the ozone concentration in the stratosphere diminishes and is no longer sufficient to absorb ultraviolet (UV) radiation which can cause high risks to human health (e.g. skin cancers and cataracts) and the terrestrial environment. The concentration of molecules that are responsible of ozone depletion is expressed in kilograms of trichlorofluoromethane equivalents **(kg CFC-11 equivalent).**

The **smog creation potential** indicator covers the emissions of pollutants such as nitrogen oxides and volatile organic compounds (VOCs) into the atmosphere. They are mainly generated by motor vehicles, power plants and industrial facilities. When reacting with the sunlight, these pollutants create smog which can affect human health and cause various respiratory problems. The concentration of pollutants causing smog are expressed in kg of ozone equivalents **(kg O_3 equivalent)**.

The **renewable/non-renewable primary energy consumption** parameters refer to the use of energy from renewable resources (e.g., wind, solar, hydro) and non-renewable resources (e.g., natural gas, coal, petroleum). The quantity of primary energy used is expressed in megajoules, on the basis of the higher heating value of the resources **(MJ, HHV).**

The **renewable/non-renewable material resources consumption** parameters represent the quantity of material made from renewable resources or non-renewable resources used to manufacture a product, excluding recovered or recycled materials. The quantity of these resources is reported in kilograms **(kg)**.

REFERENCES

Athena (Athena Sustainable Materials Institute) (2018). A Cradle-to-Gate Life Cycle Assessment of Eastern Canadian Surfaced Dry Softwood Lumber. http://www.athenasmi.org/wp-content/uploads/2018/07/CtG-LCA-of-Eastern-Canadian-Surfaced-Dry-Softwood-Lumber.pdf

CEN (European Committee for Standardization) (2012). EN 15804:2012 – Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products. European Committee for Standardization. Brussels.

CSA (2014). Engineering design in wood, CSA O86-14, Canadian Standards Association, Mississauga, Ontario, Canada.

CSA Group (2013). CSA Group Environmental Product Declaration (EPD) Program. Program Requirements. Retrieved from http://www.csaregistries.ca/assets/pdf/EPD_Registry_Program_Requirements.pdf

ecoinvent. (2021). ecoinvent 3.8 – ecoinvent. Retrieved from https://ecoinvent.org/the-ecoinvent-database/data-releases/ecoinvent-3-8/

FP Innovations (2015a). Product Category Rules (PCR) for preparing an Environmental Product Declaration for North American Structural and Architectural Wood Products. Version 2. June 2015.

FP Innovations (2015b). Carbon Tool B2B 2.18. Retrieved from https://fpinnovations.ca/ResearchProgram/environment-sustainability/epd-program/Pages/accueil.aspx

Frischknecht, R., Jungbluth, N., Althaus, H.J., Doka, G., Dones, R., Hischier, R., Hellweg, S., Humbert, S., Margni, M., Nemecek, T., and Spielmann, M. (2007). Implementation of Life Cycle Impact Assessment Methods: Data v2.0. ecoinvent report No. 3, Swiss centre for Life Cycle Inventories, Dübendorf, Switzerland.

ISO (2006a). ISO 14040. Environmental management – life cycle assessment – principles and framework. International Standard Organization. Geneva. Switzerland.

ISO (2006b). ISO 14044. Environmental management – life cycle assessment – requirements and guidelines. International Standard Organization. Geneva. Switzerland.

ISO (2017). ISO 21930. Sustainability in buildings and civil engineering works — Core rules for environmental product declarations of construction products and services. Geneva. Switzerland.

US EPA (2014). Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts (TRACI) TRACI version 2.1 User's Guide. U.S. EPA Office of Research and Development, Washington, DC, EPA/600/R-12/554.