Environmental **P**roduct **D**eclaration

Freres LUMBER CO., INC.

EPD for Mass Ply Panels produced by Freres Lumber in Lyons, Oregon

ASTM Certified Environmental Product Declaration

Program Operator	**ASTM International** 100 Barr Harbor Drive PO Box C700 West Conshohocken, PA, 19428-2959 USA www.astm.org
General Program Instructions and Version Number	ASTM Program Operator for Product Category Rules (PCR) and Environmental Product Declarations (EPDs) - General Program Instructions, version: 8.0
Declaration Owner	**Freres Lumber Company Inc.** 40519 S Cedar Mill Rd. Lyons, Oregon 97358, USA Frereslumber.com
Declaration Number	EPD160
Declared Product	Mass Ply Panels (MPP)
Declared Unit	1 m^3 of MPP produced at Freres MPP facility in Lyons, Oregon
Reference PCR and Version Number	**ISO 21930:2017** Sustainability in Building Construction — Environmental Declaration of Building Products. [7] **UL Environment**: Product Category Rules for Building-Related Products and Services **Part A:** Calculation Rules for the Life Cycle Assessment and Requirements on the Project Report, v3.2 [13] **Part B:** Structural and Architectural Wood Products EPD Requirements, v1.0 [14]
Description of Product's intended application and use	Mass Ply panels (MPP), is a veneer based engineered wood product that is characterized by large structural elements that use layers of wood for wall, floor, and roof construction [15].
Markets of Applicability	Construction Sector, Mass timber design
Date of Issue	November 5, 2020
Period of Validity	November 4, 2025
EPD Type	Product-specific EPD
EPD Scope	Cradle to Gate
Year of reported manufacturer primary data	2018
LCA Software	SimaPro v9.0.0.49
LCI Databases	USLCI [9], Ecoinvent 3.5 [14], Datasmart [8]
LCIA Methodology	TRACI 2.1 [3]
The sub-category PCR review was conducted by:	Dr. Thomas Gloria (chair) Industrial Ecology Consultants Dr. Indro Ganguly University of Washington Dr. Sahoo University of Georgia

LCA and EPD Developer This life cycle assessment was conducted in accordance with ISO 14044 and the reference PCR by:	CORRIM, Consortium for Research on Renewable Industrial Materials PO Box 2432 Corvallis, OR 97339 541-231-2726 www.corrim.org Maureen Puettmann

This declaration was independently verified in accordance with **ISO 14025:2006**.
The **UL Environment "Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Project Report," v3.2** (December 2018), in conformance with **ISO 21930:2017**, serves as the core PCR, with additional considerations from the **USGBC/UL Environment Part A Enhancement (2017)**.

☐ INTERNAL ☒ EXTERNAL

Independent Verifier This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by:	Thomas P. Gloria, Ph.D. ndustrial Ecology Consultants 35 Bracebridge Rd. Newton, MA 02459-1728 email: t.gloria@industrial-ecology.com

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.

COMPANY AND PRODUCT DESCRIPTION

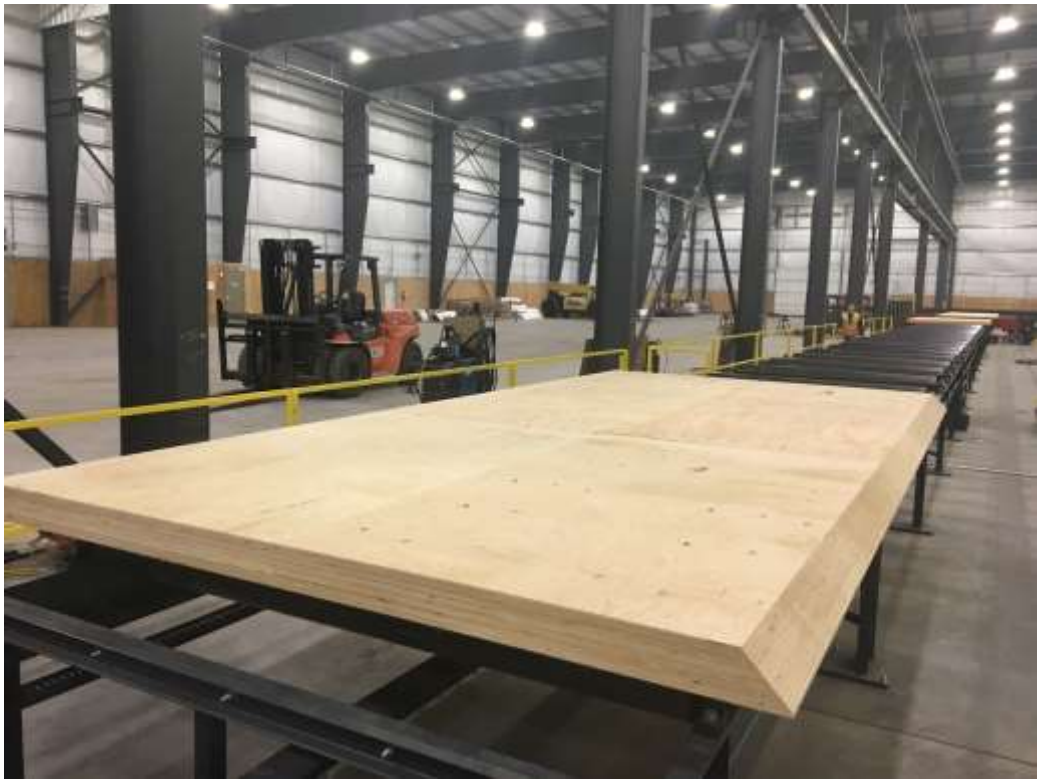
Freres Lumber Company

Established in 1922, Freres Lumber produces finished plywood products, lumber, veneers, structural composite lumber (SCL), and Mass Ply Panel (MPP) (since 12/2017) with around 450 employees. The company operates 2 veneer plants, a veneer drying facility, plywood plant, cogeneration facility, a stud mill, their own log and highway trucks, and the MPP production facility.

Mass Ply Panels

Mass Ply panels (MPP), is a veneer-based engineered wood product. MPP is a recent addition to the mass timber product line. Mass timber is a category of timber products typically characterized by large structural elements such as panels or beams that use multiple layers of wood for wall, floor, and roof construction. Products may include cross laminated timber, nail-laminated timber, glued-laminated timber, Mass Ply panels (MPP), laminated veneer lumber (LVL), and wood-concrete composites [15].

Mass Ply panels are made with Douglas-fir (*Pseudotsuga menziesii)*. Phenol formaldehyde resin is the primary adhesive type used in SCL production and melamine formaldehyde resin is used in MPP production [15].



METHODOLOGICAL FRAMEWORK

Type of EPD and Life Cycle Stages

The underlying LCA [15] investigates the MPP product system from cradle to gate. This comprises the production stage including the information modules 'A1 Extraction and upstream production', 'A2 Transport to factory' and 'A3 Manufacturing' (Figure 1).

Building Life Cycle Information Modules															
Production stage			**Construction Stage**		**Use stage**							**End-of-life stage**			
Extraction and upstream production	Transport to factory	Manufacturing	Transport to site	Installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational Energy Use	Operational Water Use	De-Construction/ Demolition	Transport to waste processing or disposal	Waste processing	Disposal
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4
X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND

Figure 1 Life Cycle Stages & Information Modules per ISO 21930. (MND: module not declared)

System Boundaries and Product Flow Diagram

The product system described in Figure 2 includes the following information modules and unit processes:

A1 Extraction and upstream production	A1 includes the cradle-to-gate production of SCL and resins that are used in MPP manufacture. The upstream resource extraction includes removal of raw materials and processing, processing of secondary material input (e.g., recycling processes) after crossing the system boundary of the previous product system. A1 also includes reforestation processes that include nursery operations (which include fertilizer, irrigation, energy for greenhouses if applicable etc.), site preparation, as well as planting, fertilization, thinning and other management operations.
A2 Transport to facility	Average or specific transportation of raw materials (including secondary materials and fuels) from extraction site or source to manufacturing site (including any recovered materials from source to be recycled in the process).
A3 Manufacturing	Manufacturing of the MPP product, including packaging (MPP wrap).

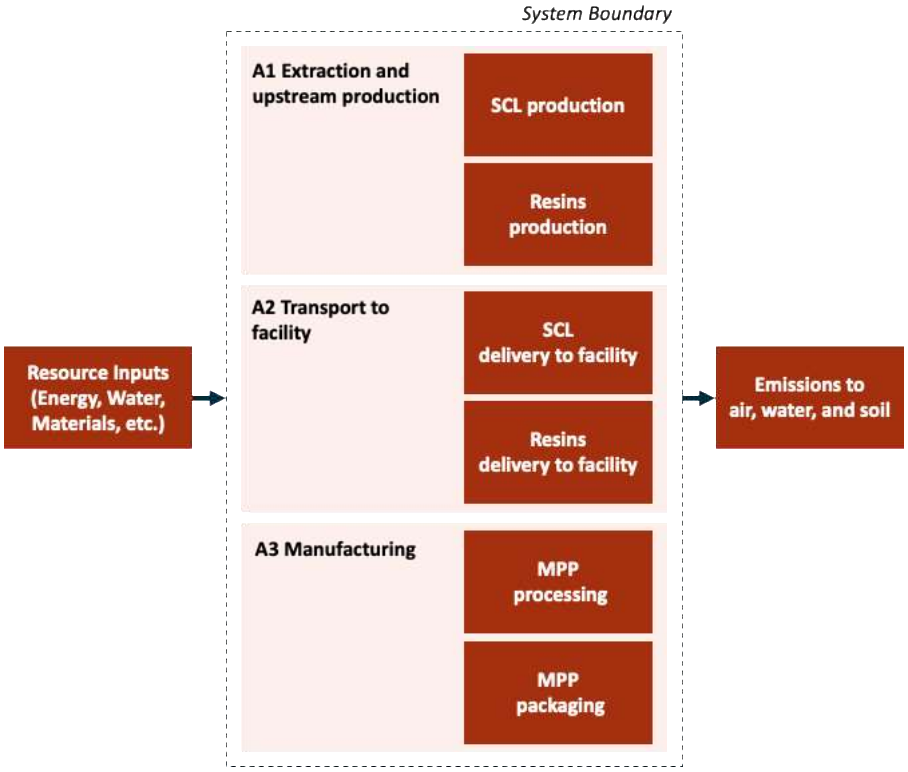


Figure 2: Cradle-to-Gate Mass Ply Panel Product System

Declared Unit

Table 1 shows the declared unit and additional product information.

Table 1: Declared Unit and Product Information

Declared Unit		
The declared unit is "the production of one cubic meter (1 m3) of MPP produced at Freres facility in Lyons, Oregon".		
Property	**Unit**	**Value**
Mass	kg	546.0
Moisture Content	%	8%
Product Composition		
Structural Composite Lumber	%	97.8%
Resins	%	2.13%

Allocation Methods

Allocation is the method used to partition the environmental load of a process when several products or functions share the same process. Processing logs for the production of structural composite lumber involves multiple processes with multiple coproduct outputs. The production of MPP from SCL also produces multiple coproduct outputs. Both the SCL production process and MPP production process were allocated on a mass basis in accordance with UL PCR 2019 and ISO 21930:2017.

Cut-off Criteria

The cut-off criteria for all activity stage flows considered within the system boundary conform with ISO 21930: 2017 Section 7.1.8. Specifically, the cut-off criteria were applied as follows:

- All inputs and outputs for which data are available are included in the calculated effects and no collected core process data are excluded.
- A one percent cut-off is considered for renewable and non-renewable primary energy consumption and the total mass of inputs within a unit process. The sum of the total neglected flows does not exceed 5% of all energy consumption and mass of inputs.
- All flows known to contribute a significant impact or to uncertainty are included.
- The cut-off rules are not applied to hazardous and toxic material flows – all of which are included in the life cycle inventory.

No material or energy input or output was knowingly excluded from the system boundary.

Data Sources

Primary and secondary data sources, as well as the respective data quality assessment are documented in the underlying LCA project report in accordance with UL PCR 2019.

This EPD estimates the impacts of forest management from the industry average Pacific Northwest forest resources LCA. [10].

Third party verified ISO 14040/44 secondary LCI data sets contribute more than 67% of total impact to any of the required impact categories identified by the applicable PCR.

Treatment of Biogenic Carbon and Sustainable Forest Management Certification

Biogenic carbon emissions and removals are reported in accordance with ISO 21930 7.2.7. and 7.2.12. Detailed information is provided in the underlying LCA in Section 2.5.

ISO 21930 requires a demonstration of forest sustainability to characterize carbon removals with a factor of -1 kg CO2e/kg CO2. ISO 21930 Section 7.2.11 Note 2 states the following regarding demonstrating forest sustainability: "Other evidences such as national reporting under the United Nations Framework Convention on Climate Change (UNFCCC) can be used to identify forests with stable or increasing forest carbon stocks." The United States UNFCCC annual report Table 6-1 provides annual NET GHG Flux Estimates for different land use categories. This reporting indicates non-decreasing forest carbon stocks and thus the source forests meet the conditions for characterization of removals with a factor of -1 kg CO2e/kg CO2.

Table 3 provides additional inventory parameters related to biogenic carbon removal and emissions.

ENVIRONMENTAL PARAMETERS DERIVED FROM LCA

Table 2 presents the LCIA and LCI parameter results for the declared unit of 1 m^3 of MPP.
The impact categories and characterization factors (CF) for the LCIA were derived from the U.S. EPA Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts -TRACI 2.1 [3].

The total primary energy consumption is tabulated from the LCI results based on the Cumulative Energy Demand Method published by ecoinvent [14]. Lower heating value of primary energy carriers is used to calculate the primary energy values reported in the study.

Other inventory parameters concerning material use, waste, water use and biogenic carbon were drawn from the LCI results. We followed the ACLCA's Guidance to Calculating non-LCIA Inventory Metrics in accordance with ISO 21930:2017 [1].

SimaPro 9.0.0.49 [11] was used to organize and accumulate the LCI data, and to calculate the LCIA results.

Table 2: LCIA Results Summary for Cradle-to-Gate production of 1 m3 of Mass Ply Panel.

Core Mandatory Impact Indicator			TOTAL	A1	A2	A3
Global warming potential, biogenic[1]	GWP_{BIO}	kg CO2e	259.16	(2,105.83)	0.18	2,364.80
Global warming potential, TRACI 2.1	GWP_{TRACI}	kg CO2e	259.16	199.47	0.18	59.51
Depletion potential of the stratospheric ozone layer	ODP	kg CFC11e	8.17E-06	6.97E-06	3.02E-10	1.20E-06
Acidification potential of soil and water sources	AP	kg SO2e	1.13	1.07	0.00	0.06
Eutrophication potential	EP	kg PO4e	0.29	0.28	0.00	0.01
Formation potential of tropospheric ozone	SFP	kg O3e	22.94	21.74	0.03	1.17
Abiotic depletion potential (ADP fossil) for fossil resources;	ADPf	MJ, NCV	4,648.67	-	-	4,648.67
Fossil fuel depletion	FFD	MJ Surplus	700.06	548.48	0.34	151.24
Use of Primary Resources						
Renewable primary energy carrier used as energy	RPRE	MJ, NCV	5,075.60	5,063.57	0.0049	12.02
Renewable primary energy carrier used as material	RPRM	MJ, NCV	12,693.47	12,693.47		
Non-renewable primary energy carrier used as energy	NRPRE	MJ, NCV	4,876.60	3,951.71	2.29	922.60
Renewable primary energy carrier used as material	NRPRM	MJ, NCV	1,151.49	1,151.49	-	-
Secondary material, secondary fuel and recovered energy						
Renewable secondary fuel	RSF	MJ, NCV	1,260.04	1,260.04		
Mandatory Inventory Parameters						
Consumption of freshwater resources	FW	m3	0.58	0.57	0.00	0.01
Indicators Describing Waste						
Hazardous waste disposed	HWD	kg	5.00E-03	3.30E-03	0.00E-03	1.70E-03
Non-hazardous waste disposed	NHWD	kg	69.71	68.51	0.05	1.14
High-level radioactive waste, conditioned, to final repository	HLRW	m3	6.08E-08	6.07E-08	1.30E-12	1.48E-10
Intermediate- and low-level radioactive waste, conditioned, to final repository	ILLRW	m3	3.21E-06	2.79E-06	6.31E-10	4.15E-07

To ensure transparency Table 3 shows additional inventory parameters related to biogenic carbon removal and emissions. The carbon dioxide flows are presented unallocated to consider co-products leaving the product system in information module A3. Even though, the system boundary of this study included only the information modules A1-A3, in accordance with ISO 21930, BCEK was reported in A5 and BCEP of the main product in C3/C4.

The net carbon emission across the entire life cycle is zero. It is assumed that all carbon removed from the atmosphere is eventually emitted to the atmosphere as CO2. Total GWP_{BIO} includes biogenic carbon emissions and removals from the information modules A1-A3, A5 and C3/C4, leading to a net zero contribution of biogenic carbon to GWP_{BIO}. Therefore, in Table 2, results for total GWP_{TRACI} and total GWP_{BIO} are equal.

[1] This indicator includes both biogenic and fossil-based carbon released. The TRACI method was modified to included CO2, biogenic removals and emissions

Table 3: Biogenic carbon inventory parameters for Mass Ply Panel

Additional Inventory Parameters		A1	A2	A3	A5	C3/C4	Total
		kg CO2e					
Biogenic Carbon Removal from Product	BCRP	(2,305.30)	-	0.00	0.00	0.00	(2,305.30)
Biogenic Carbon Emission from Product	BCEP	0.00	-	958.07	0.00	1,000.62	1,958.69
Biogenic Carbon Removal from Packaging	BCRK	-	-	(0.3712)	0.00	-	(0.3712)
Biogenic Carbon Emission from Packaging	BCEK	-	-	0.00	0.00	-	
Biogenic Carbon Emission from Combustion of Waste from Renewable Sources Used in Production	BCEW	-	-	346.98	0.00	-	346.98

INTERPRETATION AND LIMITATIONS

Comparability

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. In addition, to be compared EPDs must comply with the same core and sub-category PCRs (Part A and B) and include all relevant information modules. 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.

Forest Management

While this EPD does not address landscape level forest management impacts, potential impacts may be addressed through requirements put forth in regional regulatory frameworks, ASTM 7612-15 guidance, and ISO 21930 Section 7.2.11 including notes therein. These documents, combined with this EPD, may provide a more complete picture of environmental and social performance of wood products.

While this EPD does not address all forest management activities that influence forest carbon, wildlife habitat, endangered species, and soil and water quality, these potential impacts may be addressed through other mechanisms such as regulatory frameworks and/or forest certification systems which, combined with this EPD, will give a more complete picture of environmental and social performance of wood products.

Scope of the EPD

EPDs can complement but cannot replace tools and certifications that are designed to address environmental impacts and/or set performance thresholds – e.g. Type 1 certifications, health assessments and declarations, etc.

Data

National or regional life cycle averaged data for raw material extraction does not distinguish between extraction practices at specific sites and can greatly affect the resulting impacts.

Accuracy of Results

EPDs regularly rely on estimations of impacts; the level of accuracy in estimation of effect differs for any particular product line and reported impact when averaging data.

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