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

KALESNIKOFF

Cradle to Gate EPD for Glulam produced by Kalesnikoff in South Slocan, BC

ASTM INTERNATIONAL

1.0 General Information

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: 6.0		
Declaration Owner	**Kalesnikoff Lumber Co.** 3050 S Slocan Station Rd South Slocan, BC V0G 2G0 Mass timber products and lumber company | Kalesnikoff		
Declaration Number	EPD 296		
Declared Product	Glulam		
Declared Unit	1 m^3 of glulam produced at Kalesnikoff's facility in South Slocan, BC.		
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 [11] **Part B:** Structural and Architectural Wood Products EPD Requirements, v1.0 [12]		
Description of Product's intended application and use	Kalesnikoff glulam is a wood product constructed from lamstock grade dimensional lumber that is bonded together with strong, waterproof adhesive. The product is available in a large variety of shapes and sizes for applications where strength, durability and design are important.		
Markets of Applicability	Construction Sector, Mass timber design		
Date of Issue	March 16, 2022		
Period of Validity	March 16, 2027		
EPD Type	Product-specific EPD		
EPD Scope	Cradle-to-Gate		
Year of reported manufacturer primary data	2020		
LCA Software	SimaPro v8.5		
LCI Databases	USLCI [9], Ecoinvent 3.5 [15], 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

<table>
<tr><td>LCA and EPD Developer
This life cycle assessment was conducted in accordance with ISO 14044 and the reference PCR by:</td><td>Athena Sustainable Materials Institute
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James Salazar</td></tr>
<tr><td colspan="2">This declaration was independently verified in accordance with ISO 14025:2006[4].
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 x EXTERNAL</td></tr>
<tr><td>Independent Verifier
This life cycle assessment was independently verified in accordance with ISO 14044 [6] and the reference PCR by:</td><td>Dr. Thomas Gloria
Industrial Ecology Consultants</td></tr>
<tr><td colspan="2">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.</td></tr>
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2.0 COMPANY AND PRODUCT DESCRIPTION

Kalesnikoff is a manufacturer of wood products in North America. The company was founded in 1939, has evolved through four generations of specialty timber manufacturing experience, and has grown a legacy of trust and integrity. Located in Canada’s West Kootney’s mountains, Kalesnikoff harvests some of the highest quality fine-grain fiber in the world.

2.1 Product Description

Kalesnikoff glulam is a wood product constructed from lamstock grade dimensional lumber that is bonded together with strong, waterproof adhesive. The product is available in a large variety of shapes and sizes for applications where strength, durability and design are important.

2.2 Product Composition

Kalesnikoff’s glulam products are comprised of lumber glued together using resin. The lumber used in glulam production are produced by Kalesnikoff and are procured from sustainably managed forests in Canada.

3.0 METHODOLOGICAL FRAMEWORK

3.1 Type of EPD and Life Cycle Stages

The underlying LCA [5] investigates the 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				Substitution Effects
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	Benefits Outside System
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND

Figure 1: Life Cycle Stages and Information Modules per ISO 21930:2017.

3.2 System Boundaries and Product Flow Diagram

The product system is presented in Figure 2 below and shows the information modules that are included in the system boundary. The product system includes the production of lumber at another facility in module A1. Module A2 includes the delivery of lumber to the production facilities. The manufacturing Module A3 includes the production of glulam.

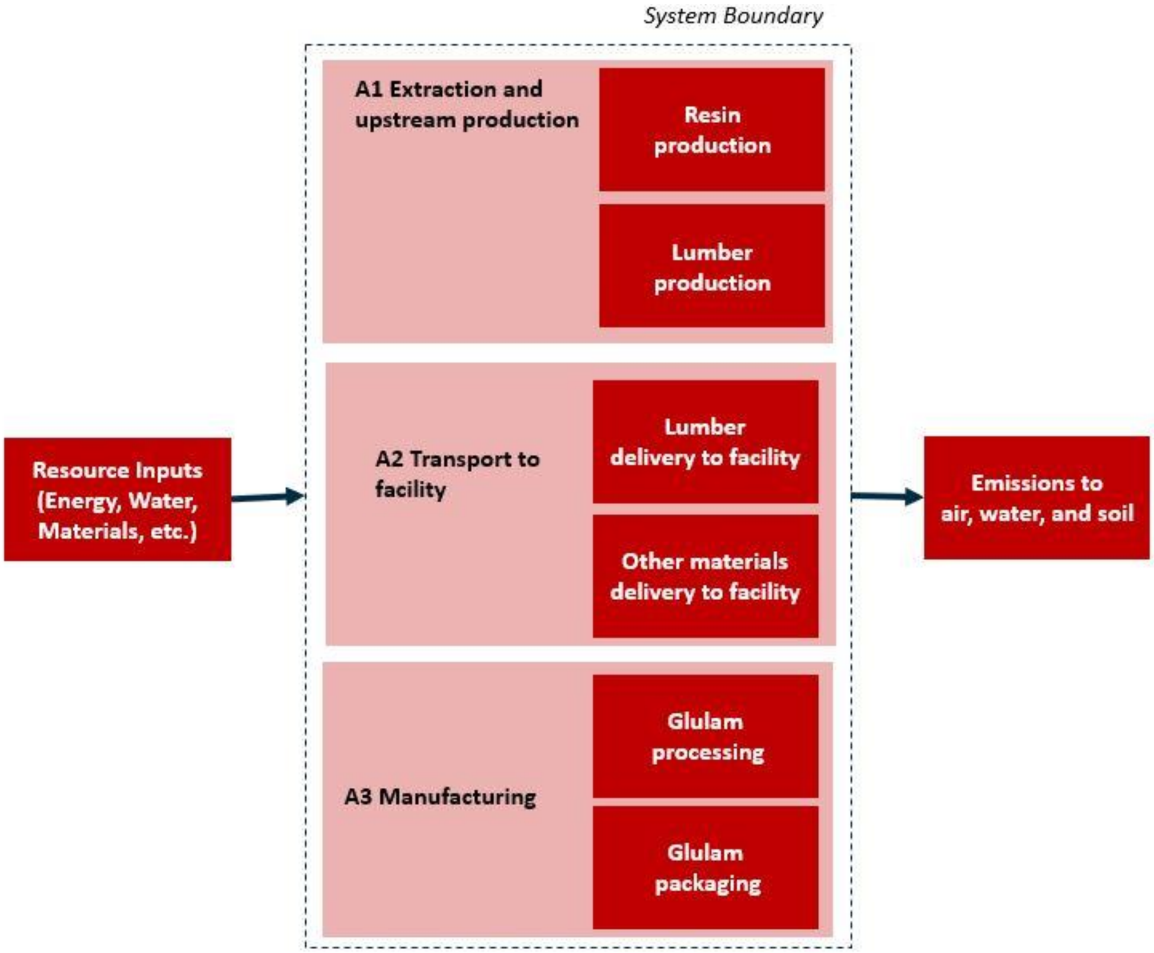

Figure 2: Cradle-to-Grave Glulam Product System

3.3 Construction and Service Life Assumptions

The product system includes average assumptions as to the transportation of the product to the construction site, 167 miles [13] as well as construction energy use, 2.23 liters diesel [2]. The reference service life for the product is 75 years which is the default specified by the UL Part A PCR [11].

3.4 Benefits Outside the System Boundary

Module D estimates the benefits outside the system boundary, natural gas displacement and the avoidance of producing glulam for future construction projects. To estimated natural gas displacement, we first calculated the potential fuel higher heating value of the product based on a higher heating value of 20.9 MJ/odkg [2]. The energy equivalent amount of natural gas was calculated based on a higher heating value or 38.66 MJ/m3 [9]. In the case that the product is recovered and reused, we assumed that the avoided plywood production was equal to the A1-A3 impacts calculated as part of this EPD.

3.5 Declared Unit

The declared unit for glulam is "*one cubic meter glulam produced at Kalesnikoff's facility in South Slocan, British Columbia*". The product properties associated with the declared unit are provided in Table 1.

Table 1: Product properties of 1 cubic meter of glulam.

Product properties:	Unit	Value
Mass (including moisture)	kg	481.68
Oven Dry Mass	odkg	446.00

3.6 Allocation Methods

Allocation is the method used to partition the environmental load of a process when several products or functions share the same process. In accordance with UL Wood PCR 2019, "mass" was selected as the parameter for allocation of the total inputs/outputs of the production system.

3.7 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.

3.8 Data Sources

Primary and secondary data sources, as well as the respective data quality assessment are documented in the underlying LCA project report [2] in accordance with UL PCR 2019. This EPD estimates the impacts of forest management by the use of average data for Pacific Northwest log production. 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.

3.9 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 Section 5.1 of the underlying LCA [2]. Table 2 provides additional inventory parameters related to biogenic carbon removal and emissions.

To consider the biogenic carbon dynamics that occur in landfills, UL Environment published an Appendix to the reference PCR that estimates the emissions from landfilling of wood products. The Landfill Modeling for Biogenic Carbon Appendix A is based on the United States EPA WARM model and aligns with the biogenic accounting rules in ISO 21930 Section 7.2.7 and Section 7.2.12.

The WARM model is documented by the EPA at https://www.epa.gov/warm/documentation-waste-reduction-model-warm. UL's wood product PCR adopted the WARM model estimations and published those assumptions under Appendix A of the PCR. These background accounting assumptions form the basis for landfill modeling that adjusts the carbon storage as a portion of the initial carbon while accounting for remaining carbon converted to landfill gas. It does not assign the percentage of the wood product sent to the landfill.

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 evidence 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.

4.0 ENVIRONMENTAL PARAMETERS DERIVED FROM LCA

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 [6]. SimaPro v8.5 [10] was used to accumulate the LCI data and to calculate the LCIA results.

The total primary energy consumption is tabulated from the LCI results based on the Cumulative Energy Demand Method published by ecoinvent [18]. 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. ACLCA's Guidance to Calculating non-LCIA Inventory Metrics was followed in accordance with ISO 21930:2017 [1].

Wood products are assumed to largely remain undecomposed in landfills thus permanently storing biogenic carbon. The net effect of the biogenic carbon flowing into the product system in A1 and the total of all outflows that are somewhat less than the A1 input when landfilling is assumed, is that the global warming potential for biogenic carbon is negative. The assumptions regarding biogenic carbon landfill dynamics are described in detail in UL PCR 2019 Addendum 1.

The U.S. Environmental Protection Agency has Materials Management Fact Sheet that assess trends in material recycling, composting, combustion with energy recovery and landfilling in the U.S. For durable wood products (such as construction materials) the 2017 estimates were 0% recycling, 0% composting, 18% combustion with energy recovery and 82% landfilling as a percentage of wood material generated by weight. This assessment can be adjusted for alternative end-of-life scenarios such as 100% landfill or 100% reuse.

4.1 Detailed Biogenic Carbon Results

To ensure transparency, Table 2 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.

Table 2: Biogenic carbon inventory parameters

Additional Inventory Parameters		Total	A1	A2	A3	A5	C3/C4
Biogenic Carbon Removal from Product	kg CO2	-1045.63	-1045.63	-	-	-	-
Biogenic Carbon Emission from Product	kg CO2	1015.51	-	-	197.84	-	817.67
Biogenic Carbon Removal from Packaging	kg CO2	-	-	-	-	-	-
Biogenic Carbon Emission from Packaging	kg CO2	-	-	-	-	-	-
Biogenic Carbon Emission from Combustion of Waste from Ren. Sources Used in Production	kg CO2	30.12	-	-	30.12	-	-
Net Biogenic Carbon Emissions			**kg CO2**	**0.00**			

5.0 RESULTS

Table 3 shows the results for the *cradle-to-gate* (A1-A3) glulam product system. The cradle-to-gate results align with the North American industry average EPD for glulam developed by the American Wood Council and Canadian Wood Council in 2020. The cradle-to-gate results are identical to the A1-A3 results that are presented in Section 4.3 as a part of the cradle-to-gate plus end-of-life system boundaries except for the accounting of biogenic carbon. In the cradle-to-gate results, the biogenic carbon stored in the primary product is conservatively accounted as an emission in module A3 as the end-of-life modules (C1-C4) are not considered.

Table 3: Results Summary for 1 m^3 glulam Cradle-to-Gate Scope

Core Mandatory Impact Indicator	Unit	A1-A3	A1	A2	A3
Global warming potential – Total	kg CO2e	124.50	-953.23	0.33	1077.41
Global warming potential - Fossil	kg CO2e	124.50	92.40	0.33	31.78
Global warming potential - Biogenic	kg CO2e	0.00	-1045.63	0.00	1045.63
Depletion potential of the stratospheric ozone layer	kg CFC11e	2.27E-06	1.03E-06	1.38E-11	1.25E-06
Acidification potential of soil and water sources	kg SO2e	0.93	0.71	0.00	0.22
Eutrophication potential	kg Ne	0.07	0.05	0.00	0.02
Formation potential of tropospheric ozone	kg O3e	16.52	14.02	0.10	2.41
Abiotic depletion potential (ADPfossil)	MJ, NCV	1766.23	1337.90	4.68	423.65
Fossil fuel depletion	MJ Surplus	231.70	185.70	0.69	45.31
Use of Primary Resources					
Renewable primary energy used as energy	MJ, NCV	491.11	97.14	0.00	393.97
Renewable primary energy used as material	MJ, NCV	11920.18	11920.18	0.00	0.00
Non-renewable primary energy used as energy	MJ, NCV	2351.80	1627.79	4.96	719.05
Non-renewable primary energy used as material	MJ, NCV	0.00	0.00	0.00	0.00
Secondary Material, Secondary Fuel and Recovered Energy					
Secondary material	kg	0.00	0.00	0.00	0.00
Renewable secondary fuel	MJ, NCV	0.00	0.00	0.00	0.00
Non-renewable secondary fuel	MJ, NCV	0.00	0.00	0.00	0.00
Recovered energy	MJ, NCV	0.00	0.00	0.00	0.00
Mandatory Inventory Parameters					
Consumption of freshwater resources	m3	0.37	0.17	0.00	0.20
Indicators Describing Waste					
Hazardous waste disposed	kg	0.00	0.00	0.00	0.00
Non-hazardous waste disposed	kg	0.00	0.00	0.00	0.00
High-level radioactive waste	m3	0.00	0.00	0.00	0.00
Intermediate- and low-level radioactive waste	m3	0.00	0.00	0.00	0.00
Components for re-use	kg	0.00	0.00	0.00	0.00
Materials for recycling	kg	0.00	0.00	0.00	0.00
Materials for energy recovery	kg	0.00	0.00	0.00	0.00
Recovered energy exported	MJ, NCV	0.00	0.00	0.00	0.00

6.0 INTERPRETATION

The primary sources of impacts across the life cycle are the manufacturing of the product itself (Modules A1-A3) and the net flows of biogenic carbon. Table 2 shows that the flows of biogenic carbon out of the system in Module A3 (combustion emissions and the export of coproducts to other product systems) and Module C4 (landfill gas and incineration emissions) are significantly less than the flows of biogenic carbon into the system in Module A1 (removal of biomass from a net neutral sustainable forest). The permanent biogenic carbon storage is so significant that this net benefit is larger than the total fossil emissions from all other modules and causes the total global warming potential to be negative. The total global warming potential means the product system removes more greenhouse gases from the atmosphere than are emitted in its production and disposal combined.

7.0 LIMITATIONS

7.1 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.

7.2 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.

7.3 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.

7.4 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.

7.5 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.

REFERENCES

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3. Bare, J. (2012) Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts (TRACI) - Version 2.1.

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10. PRé Consultants BV (2018) SimaPro v8.5 LCA Software

11. UL Environment (2018) Product Category Rule (PCR) Guidance for Building-Related Products and Services, Part A Life Cycle Assessment Calculation Rules and Report Requirements V 3.2.

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13. U.S. Department of Transportation, Bureau of Transportation Statistics; and, U.S. Department of Commerce, U.S. Census Bureau. (2020). 2017 Commodity Flow Survey Final Tables. [CF1700A21].

14. U.S. Environmental Protection Agency (2019) Advancing Sustainable Materials Management: 2017 Fact Sheet (Table 4 values for Durable Goods).

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