# Environmental Product Declaration

National Association of Home Builders

Log and Timber Homes Council

## A Cradle-to-Gate EPD of Milled log wall products (MLW)

ASTM INTERNATIONAL

According to
ISO 21930
ISO 14025
ISO 14040/44

| **Summary Results –per $m^3$**<br>***Full Results in Table 1*** | | **Cradle-to-Gate Total** |
|---|---|---|
| Global warming potential | kg $CO_2e$ | 1.43E+02 |
| Acidification potential of soil and water sources | kg $SO_2e$ | 8.45E-01 |
| Eutrophication potential | kg Ne | 2.27E-01 |
| Depletion potential of the stratospheric ozone layer | kg CFC11e | 3.14E-05 |
| Formation potential of tropospheric ozone | kg $O_3e$ | 1.72E+01 |
| Abiotic depletion potential (ADPfossil) for fossil resources | MJ, NCV | 1.98E+03 |

# 1.0 General Information

| | |
|---|---|
| **EPD Program and Program Operator** | **ASTM International**<br>100 Barr Harbor Drive<br>PO Box C700<br>West Conshohocken, PA,<br>19428-2959 USA<br>www.astm.org<br>ASTM INTERNATIONAL<br>Helping our world work better |
| **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 |
| **Manufacturer** | National Association of homebuilders<br>**National Housing Center**<br>1201 15th Street, NW<br>Washington, DC 20005<br>https://nwfa.org<br>NAHB National Association of Home Builders \| Log and Timber Homes Council |
| **Declaration Number** | EPD 998 |
| **Declared Product** | Milled log wall products (MLW) |
| **Declared Unit** | 1 $m^3$ of MLW produced. |
| **Reference PCR and Version Number** | **ISO 21930:2017** Sustainability in Building Construction — Environmental Declaration of Building Products. [7]<br>**ISO 14040/44:2006**<br>Underwriters Laboratory, Product Category Rule for Architectural and Structural Wood Products. Version 1.1. (2020) |
| **Markets of Applicability** | Construction Sector, Building homes |
| **Date of Issue** | 25.09.2025 |
| **Period of Validity** | 24.09.2030 |
| **EPD Type** | Industry Average EPD |

| | | | |
|---|---|---|---|
| **EPD Scope** | Cradle-to-Gate | | |
| **Year of reported manufacturer primary data** | 2019 | | |
| **LCA Software** | SimaPro v9.2 | | |
| **LCI Databases** | USLCI, Ecoinvent 3.9 , Datasmart 2023 | | |
| **LCIA Methodology** | TRACI 2.1 [3] | | |
| **The sub-category PCR review was conducted by:** | Jack Geibig, Chair<br>Ecoform | Dr. Thomas Gloria<br>Industrial Ecology Consultants | Thaddeus Owen |
| **LCA and EPD Developer**<br>This life cycle assessment was conducted in accordance with ISO 14044 and the reference PCR by: | **Athena Sustainable Materials Institute**<br>100 Broadview Avenue, Suite 909<br>Ottawa, ON K1S 5P6<br><br>https://www.athenasmi.org/<br>Athena | | |
| This declaration was independently verified in accordance with **ISO 14025:2006[4]**. Environmental declarations from different programs (ISO 14025) may not be comparable.<br>The **UL Environment "Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Project Report," v3.2** (September 2018), based on **ISO 21930:2017 and CEN Norm EN 15804 (2012),** serves as the core PCR, with additional considerations from the **USGBC/UL Environment Part A Enhancement (2017)**.<br>☐ INTERNAL x EXTERNAL | | | |
| **Independent Verifier**<br>This life cycle assessment was independently verified in accordance with ISO 14044 [6] and the reference PCR by: | **Tim Brooke**<br>100 Barr Harbor Drive<br>PO Box C700<br>West Conshohocken, PA,<br>19428-2959 USA<br>www.astm.org | | |
| **LCA and EPD Manufacturer Participants** | | | |
| NAHB National Association of Home Builders \| Log and Timber Homes Council | | | |

## About the National Wood Flooring Association

NAHB collaborates with industry partners to quantify and report the environmental impact of building materials and products. For example, in the LCA report you shared, NAHB commissioned the Athena Sustainable Materials Institute to conduct a cradle-to-gate LCA of log home and timber frame products. The study was aligned with the association's goal of promoting sustainable building practices and creating transparency in environmental impacts across the construction sector. Through such initiatives, the NAHB supports efforts toward more sustainable construction practices by providing detailed data on environmental performance to industry stakeholders, including architects, policymakers, and manufacturers. This EPD initiative helps builders meet criteria for sustainable building certifications like LEED and Green Globes, advancing environmentally friendly construction practices in North America. Detailed information about NAHB can be found at https://www.nahb.org/

# 2. PRODUCT DESCRIPTION

**Milled Log Wall Products (MLW)**

Milled Log Wall (MLW) products are precision-crafted construction components made from logs that are machine-processed to ensure uniform dimensions and smooth surfaces for efficient installation. These logs offer exceptional structural integrity while maintaining the aesthetic appeal of natural wood, making them ideal for eco-friendly buildings that blend with their natural surroundings. Additionally, MLW products provide excellent natural insulation, enhancing energy efficiency by reducing heat transfer, and lower energy consumption.

**MLW Product Variations**

Full conformance with the PCR for wood products allows EPD comparability only when all life cycle stages (A1 to C4 and beyond, if applicable) have been considered, when EPDs comply with all referenced standards, utilize the same sub-category Part B PCR, and apply equivalent scenarios related to the construction works. It is important to note that variations and deviations may still occur. MLW products are available in different variations to meet a variety of construction needs. Key variations include:

- **Log Diameter:** Logs are available in a range of diameters, offering flexibility for different structural applications.
- **Species:** Manufactured from both softwoods (e.g., pine, spruce) and hardwoods (e.g., oak, maple) to provide the desired strength and appearance.
- **Surface Finish:** Options include smooth-planed, tongue-and-groove, or bevelled edges for aesthetic or functional preferences.
- **Joinery Options:** Includes precision-cut profiles for tight-fitting connections, such as saddle notches, dovetail corners or tongue-and-groove joints, ensuring stability and durability.

**Source of Timber and Sustainability**

MLW products are crafted from timber sourced from sustainably managed forests in North America. The manufacturing process follows sustainable forestry practices to minimize environmental impact. Key aspects include:

- **Sustainable Growth:** Timber harvesting aligns with sustainable forestry practices, ensuring that forest growth exceeds the rate of harvest.
- **Selective Harvesting:** Selective logging techniques maintain forest health and biodiversity, preventing clear-cutting.
- **Common Species:** Pine, spruce, fir, oak, cypress and cedar are among the typical species used, valued for their strength, durability, and suitability for log wall applications.

# 3. METHODOLOGY

The underlying LCA investigates the lifecycle stages of Milled log wall products production in the United States and Canada from cradle-to-gate.

## System Boundaries and Product Flow Diagram

The scope for Milled Log Wall (MLW) products follows a cradle-to-gate system boundary, covering environmental impacts from raw material extraction to the finished product ready for shipment. It consists of three modules: A1 – Raw Material Production, which includes log harvesting, reforestation, thinning, nursery operations, fertilization, and preparation of secondary materials; A2 – Raw Material Transportation, which details the movement of logs and other inputs to manufacturing sites via trucks, rail, or ships; and A3 – Manufacturing, where logs are milled to precise dimensions, shaped into profiles such as tongue-and-groove, and finished according to design specifications. The products are then packaged for delivery.

The manufacturing process consumes electricity, propane, and wood fuels, along with consumables like motor oil and hydraulic fluids. It also generates co-products such as wood chips and sawdust, which are reused as bioenergy or sold to other industries. This cradle-to-gate approach ensures a comprehensive and transparent assessment of the environmental impacts associated with MLW products, promoting sustainable building practices and environmentally conscious decision-making.

| 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 | 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 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |

**Figure 2: Life Cycle Stages and Information Modules per ISO 21930:2017**

## Construction and Service Life Assumptions

The construction and service life assumption aligns with typical building industry standards. While the report emphasizes the cradle-to-gate scope, meaning that the product's full lifecycle (including end-of-life) is not assessed here, the data suggests that SRT products have a long service life, contributing to their sustainability performance.

## Declared Unit

The declared unit for the MLW product is defined as one cubic meter (1 $m^3$) of milled log wall. This unit provides a consistent basis for measuring the product's environmental impacts across different stages of production. The MLW product system primarily consists of wood with a density of 439.8 dry kg/$m^3$.

## Data Sources

The data sources for this study include both primary data collected directly from eight manufacturing facilities across North America and secondary data from publicly available databases such as DATASMART 2023 and Ecoinvent **3.9**. Primary data reflects facility-specific information on energy use, material inputs, and manufacturing processes for the 2021 production year. Secondary data covers aspects such as transportation and raw material extraction.

## Treatment of Biogenic Carbon

The report follows the guidelines of UL PCR Part B and ISO 21930 to account for biogenic carbon. North American forests are assumed to have a neutral forest carbon stock, meaning that the biogenic $CO_2$ emitted during biomass combustion (e.g., for kiln-drying) does not contribute to the overall global warming potential. Although the cradle-to-gate scope of this study does not cover end-of-life emissions, the biogenic carbon stored in the product is quantified as 806.31 kg $CO_2$ equivalent per $m^3$ (assuming 50% carbon content). This ensures that the carbon sequestration within the wood product is transparently reported and can be used in future cradle-to-grave

assessmentsBiogenic carbon emissions and removals are reported in accordance with ISO 21930 7.2.7. and 7.2.12. Detailed information is provided in Section 4 of the underlying LCA.

### Allocation Procedures:

Allocation procedures are conducted in accordance with ISO 14044 and ISO 21930. When processes produce multiple co-products, inputs and outputs are allocated to the products based on physical relationships (such as mass or energy content) or economic value, depending on data availability and relevance. When neither physical nor economic allocation is possible, system expansion is applied to avoid allocation. Specific allocation details for coproducts are provided within the life cycle inventory documentation.

### Cut-off Criteria:

The cut-off criteria applied in this study exclude flows that collectively contribute less than 1% of the total mass, energy, or environmental significance of the product system. All significant inputs and outputs are included. No known flows are deliberately excluded from this EPD.

### Health, Safety and Environmental Aspects

This product does not contain hazardous, dangerous, or regulated substances that are known to adversely affect human health or the environment. The product is free from substances that are restricted or subject to specific regulations under applicable health, safety, and environmental legislation. This declaration is made in accordance with ISO 21930:2017 standards for sustainability in building construction.

## 4. LCA Results

The Life Cycle Assessment (LCA) results for MLW products provide a comprehensive environmental profile from cradle-to-gate. The impact categories and characterization factors are derived from the U.S. EPA TRACI 2.1 methodology. The LCA modeling was performed using SimaPro v9.1, which compiled the life cycle inventory (LCI) data and calculated the life cycle impact assessment (LCIA) results.
The contribution analysis shows that manufacturing (A3) is the most impactful phase, contributing approximately 45.8% to the Global Warming Potential (GWP), followed by raw material production (A1) at 37.8% and transportation (A2) at 16.4%. The efficient use of co-products like wood chips and sawdust for bioenergy demonstrates the alignment of MLW production with sustainable practices. These LCA results offer a transparent understanding of the environmental performance of MLW products, promoting their use in eco-friendly construction and supporting the integration of carbon-storing building materials

**Table 1: LCIA Results Summary for Cradle-to-Gate production of 1 $m^3$ of MLW-absolute basis**

| Core Mandatory Impact Indicator | Unit | Total | A1 | A2 | A3 |
|---|---|---|---|---|---|
| Global warming potential – w/biogenic $CO_2$ | kg $CO_2$e | 1.43E+02 | -8.15E+02 | 2.34E+01 | 9.35E+02 |
| Global warming potential – TRACI 2.1 | kg $CO_2$e | 1.43E+02 | 5.39E+01 | 2.34E+01 | 6.57E+01 |
| Acidification potential of soil and water sources | kg $SO_2$e | 8.45E-01 | 4.40E-01 | 1.29E-01 | 2.76E-01 |
| Eutrophication potential | kg Ne | 2.27E-01 | 5.55E-02 | 1.03E-02 | 1.61E-01 |
| Depletion potential of the stratospheric ozone layer | kg CFC11e | 3.14E-05 | 3.05E-05 | 5.02E-08 | 8.13E-07 |
| Formation potential of tropospheric ozone | kg $O_3$e | 1.72E+01 | 7.18E+00 | 3.70E+00 | 6.32E+00 |
| Abiotic depletion potential (ADP fossil) for fossil resources | MJ, NCV | 1.98E+03 | 7.94E+02 | 2.90E+02 | 8.99E+02 |
| **Use of Primary Resources** | | | | | |
| Renewable primary energy carrier used as energy | MJ, NCV | 9.78E+01 | 3.91E+01 | 5.43E-01 | 5.82E+01 |
| Renewable primary energy carrier used as material | MJ, NCV | 1.10E+04 | 1.10E+04 | 0.00E+00 | 0.00E+00 |

| | | | | | |
|---|---|---|---|---|---|
| Non-renewable primary energy carrier used as energy | MJ, NCV | 2.31E+03 | 8.26E+02 | 2.94E+02 | 1.19E+03 |
| Non-renewable primary energy carrier used as material | MJ, NCV | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| **Secondary Material, Secondary Fuel, and Recovered Energy** | | | | | |
| Secondary material | kg | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Renewable secondary fuel | MJ, NCV | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Non-renewable secondary fuel | MJ, NCV | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Recovered energy | MJ, NCV | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| **Mandatory Inventory Parameters** | | | | | |
| Consumption of freshwater resources | $m^3$ | 4.51E+00 | 3.65E-01 | 3.86E+00 | 2.80E-01 |
| **Indicators Describing Waste** | | | | | |
| Hazardous waste disposed | kg | 3.86E-01 | 3.58E-01 | 5.27E-04 | 2.74E-02 |
| Non-hazardous waste disposed | kg | 5.68E+01 | 3.39E+00 | 4.05E-01 | 5.30E+01 |
| High-level radioactive waste | $m^3$ | 1.67E-07 | 1.45E-08 | 2.32E-09 | 1.51E-07 |
| Intermediate- and low-level radioactive waste | $m^3$ | 1.41E-06 | 6.75E-08 | 1.12E-08 | 1.33E-06 |
| Components for re-use | kg | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Materials for recycling | kg | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Materials for energy recovery | kg | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Recovered energy exported from the product system | MJ, NCV | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| **Additional Inventory Parameters** | | | | | |
| Biogenic Carbon Removal from Product | kg $CO_2$ | -1.09E+03 | -1.09E+03 | 0.00E+00 | 0.00E+00 |
| Biogenic Carbon Emission from Product | kg $CO_2$ | 8.27E+02 | 0.00E+00 | 0.00E+00 | 8.27E+02 |
| Biogenic Carbon Removal from Packaging | kg $CO_2$ | -5.36E-01 | -5.36E-01 | 0.00E+00 | 0.00E+00 |

# 5. LIMITATIONS

**Comparability**

This study does not include comparative assertions, making it difficult to benchmark MLW products against other building materials. Differences in system boundaries, allocation methods, and data sources would need to be harmonized to enable meaningful comparisons, limiting the use of the results for competitive product evaluations or market-based comparisons. Environmental declarations from different programs (ISO 14025) may not be comparable. Comparison of the environmental performance of wood products using EPD information shall be based on the product's use and impacts at the construction works level, and therefore EPDs may not be used for comparability purposes when not considering the construction works energy use phase as instructed under this PCR".

**Forest Management**

The study assumes that North American forests are carbon neutral, meaning there is no net carbon loss due to sustainable forestry practices. However, this assumption may not fully account for regional variations in forest management, changes in land use, or unforeseen environmental events. These factors could affect the actual carbon balance and introduce uncertainty regarding the long-term sustainability of biogenic carbon sequestration.

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 the environmental and social performance of wood products.

**EPD Scope**

The cradle-to-gate scope limits the EPD by excluding the product's use phase, maintenance, and end-of-life stages. This restricts the report's ability to offer insights into the total environmental performance of HLW products in real-world applications.

**Accuracy of Results**

The accuracy of the results may be affected by the limited sample size, as only eight manufacturing facilities were included. Additionally, the reliance on secondary data for aspects such as transportation and raw material extraction introduces variability. While primary data collection reflects actual production practices, averaging across facilities could mask specific differences, reducing the precision of the environmental impact assessments for individual production sites.

# 6. REFERENCES


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