Environmental Product Declaration

U.S. Oriented Strand Board

American Wood Council

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 Rules. Version: 8.0, Revised 04/29/20
DECLARATION OWNER	American Wood Council
DECLARATION NUMBER	EPD 976
DECLARED PRODUCT	Oriented Strand Board produced in the United States
DECLARED UNIT	1 m^3 of Oriented Strand Board
REFERENCE PCR AND VERSION NUMBER	ISO 21930:2017 Sustainability in Building and Civil Engineering works – Core Rules for environmental Product Declaration of Construction Products and Services. [9] 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 2018 [17] Part B: Structural and Architectural Wood Products EPD Requirements, v1.1 2020 [18]
DESCRIPTION OF PRODUCT'S INTENDED APPLICATION AND USE	Oriented strand board is used in building construction (residential and commercial), furniture manufacturer, and others
MARKETS OF APPLICABILITY	Construction Sector, North America
DATE OF ISSUE	May 7, 2025
PERIOD OF VALIDITY	5 years
EPD TYPE	Industry-average
EPD SCOPE	Cradle to gate
YEAR OF REPORTED MANUFACTURER PRIMARY DATA	2022/2023
LCA SOFTWARE	SimaPro v9.6
LCI DATABASES	USLCI [12], Ecoinvent 3.9.1 [19], Datasmart 2023 [11]

LCIA METHODOLOGY	TRACI 2.1 v1.08 [4], CML-IA Baseline V3.08, CED, LHV 1.0
THE SUB-CATEGORY PCR REVIEW WAS CONDUCTED BY:	Dr. Thomas Gloria (chair) t.gloria@industrial-ecology.com
LCA AND EPD DEVELOPER This life cycle assessment was conducted in accordance with ISO 14044 and the reference PCR by:	The Consortium for Research on Renewable Industrial Materials (CORRIM) PO Box 2432 Corvallis, OR 97330 541-231-2627 www.corrim.org

This declaration was independently verified in accordance with ISO 14025:2006 [6].
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 with additional considerations from the USGBC/UL Environment Part A Enhancement (2017).

Tim Brooke, ASTM International

☐ Internal ☐ x External

INDEPENDENT VERIFIER This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by:	Dr. Thomas Gloria (chair) t.gloria@industrial-ecology.com

LIMITATIONS

- Environmental declarations from different programs (ISO 14025) may not be comparable.
- Comparison of the environmental performance of Structural and Architectural 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.
- Full conformance with the PCR for oriented strand board allows EPD comparability only when all stages of a life cycle have been considered, when they comply with all referenced standards (ISO 21930:2017 §5.5, use the same sub-category Part B PCR, and use equivalent scenarios with respect to construction works. However, variations and deviations are possible. It should be noted that different LCA software and background LCI datasets may lead to different results for upstream or downstream of the life cycle stages declared.

Description of Industry and Product

Description of Oriented Strand Board Industry

The oriented strand board (OSB) industry is a subset of the very broad forest products industry which also produces plywood, fiberboard, particleboard, paper, cabinetry, furniture, millwork, and other products derived from trees.

The OSB production region represented in this EPD includes facilities located in northern and southern regions of the United States (U.S.). OSB production facilities accounted for 68 percent (10.5 million MSF; 9.3 million m^3) of the 15.4 million MSF 3/8-inch basis of U.S. OSB capacity in 2022 (FEA 2024). Of the reporting facilities, the annual production ranged from about 99,000 MSF to 835,000 MSF with a weighted average of 538,003 MSF, 3/8-inch basis (476,079 m3, 9.5 mm basis).

This EPD represents the cradle-to-gate energy and materials required for manufacturing OSB in the U.S. All members of the American Wood Council and/or APA – The Engineered Wood Association that meet the eligibility requirement are participants in this EPD.

OSB is categorized by United Nations Standard Products and Services Code (UNSPSC) 111220 02 and Construction Specifications Institute (CSI) codes for sheathing 06 16 00, 06 16 23 for subflooring, and 06 16 26 for underlayment (Table 1).

Table 1. United Nations Standard Products and Services Code (UNSPSC) and Construction Specification Institute (CSI) MasterFormat Code for OSB.

<table>
<tr><th>Classification Standard</th><th>Category</th><th>Subcategory</th><th>Product Code</th></tr>
<tr><td>UNSPSC</td><td>Engineered wood products</td><td>Particleboard</td><td>111220 02</td></tr>
<tr><td rowspan="3">CSI</td><td rowspan="3">Oriented strand board (OSB)</td><td>Sheathing</td><td>06 16 00</td></tr>
<tr><td>Subflooring</td><td>06 16 23</td></tr>
<tr><td>Underlayment</td><td>06 16 26</td></tr>
</table>

The most common species used, as reported by the facilities, is southern pine (83%) followed by various hardwoods including aspen (16%) (Table 2). Southern pine is a mixture of several species with similar characteristics. The species are primarily longleaf pine (*Pinus palustris*), loblolly pine (*P. taeda*), short leaf pine (*P. echinata*), and slash pine (*P. elliottii*).

Table 2. Species and Representation for Oriented Strand Board.

Species Grouping	Scientific Name	Representation
Southern pine	*Pinus spp.*	82.95%
Maple	*Acer spp.*	9.53%
Aspen/Balsam poplar	*Populus spp.*	6.01%
Eastern pines	*Pinus spp.*	0.67%
Birch	*Betula spp.*	0.45%
Tamarack	*Larix spp.*	0.33%
Basswood	*Tilia spp.*	0.06%
		100.00%

Description of Product

Oriented strand board is an engineered, wood-based structural panel made of layers of wood ‘strands’ (Table 3). Strands are typically 114 to 152 mm (4.5 to 6 in) long 12.7 mm (0.5 inch) wide, and 0.6 to 0.7 mm (0.023 to 0.027 in) thick (FPL 2021). These strands are oriented along their long axis to provide optimal product properties in the panel. The outer layers consist of strands aligned in the long direction of the panel (typically 4-foot x 8-foot), while the middle layer includes smaller strands that are oriented at 90 degrees to the outer layers. The strands used in OSB are bonded with thermosetting resins; wax is commonly added to the panel to increase water resistance properties.

OSB can be used in the residential and commercial building sectors as subflooring, single-layer flooring, wall and roof sheathing, sheathing ceiling/deck, structural insulated panels, webs for wood I-joists, industrial containers, mezzanine decks, and furniture. (FPL 2021, APA).

Although OSB is produced in different grades and thicknesses (Table 3), a commonly used unit of volume in the industry is one thousand square feet (MSF) on a 3/8-inch basis (0.885 cubic meters, 9.525 mm basis). Most OSB panels are manufactured in conformance with the U.S. Department of Commerce Voluntary Product Standard PS 2. PS 2 is recognized in the International Building Code (IBC) and International Residential Code (IRC) (APA 2017).

Table 3. Common Thickness and Use of Oriented Strand Board Panels. (Source: APA)

Thickness	Common use
3/8”	Sheathing
7/16”	Sheathing
15/32”	Sheathing
1/2”	Sheathing
19/32”	Sheathing/Flooring
5/8”	Sheathing/Flooring
23/32”	Sheathing/Flooring
3/4”	Sheathing/Flooring
7/8”	Flooring
1”	Flooring
1-1/8”	Flooring

The product profile presented in this EPD is for a declared unit of 1 cubic meter (1 m^3) of OSB. One cubic meter of OSB weighs 651 kg, excluding the variable moisture content (Table 4).

Table 4. Properties of 1 m^3 Oriented Strand Board.

Average Product Composition	Unit	Weighted Avg.
Mass of product	kg	689.15
Density, oven dry	kg/m^3	650.88
Density @ 5% MC	kg/m^3	689.15
Moisture Content	%	4.55
Thickness	mm	9.525

Oriented Strand Board Production

The production process at the mill begins with conditioning, debarking, and bucking (cutting to length) of the logs. The wood is then cut into thin strands. The green strands are dried, screened to remove fines and oversized material, and then blended with resin and wax. The adhesives systems used are PF and pMDI. The blended flakes are formed in a three-layer mat with cross-directional layers and are pressed under a combination of pressure and high temperature to produce a rigid and dense board. The OSB boards are cooled, sawn to appropriate size, grade stamped, stacked in bundles, and packaged for shipping (Figure 1). The OSB manufacturing process is best described by eight unique process steps (Table 5).

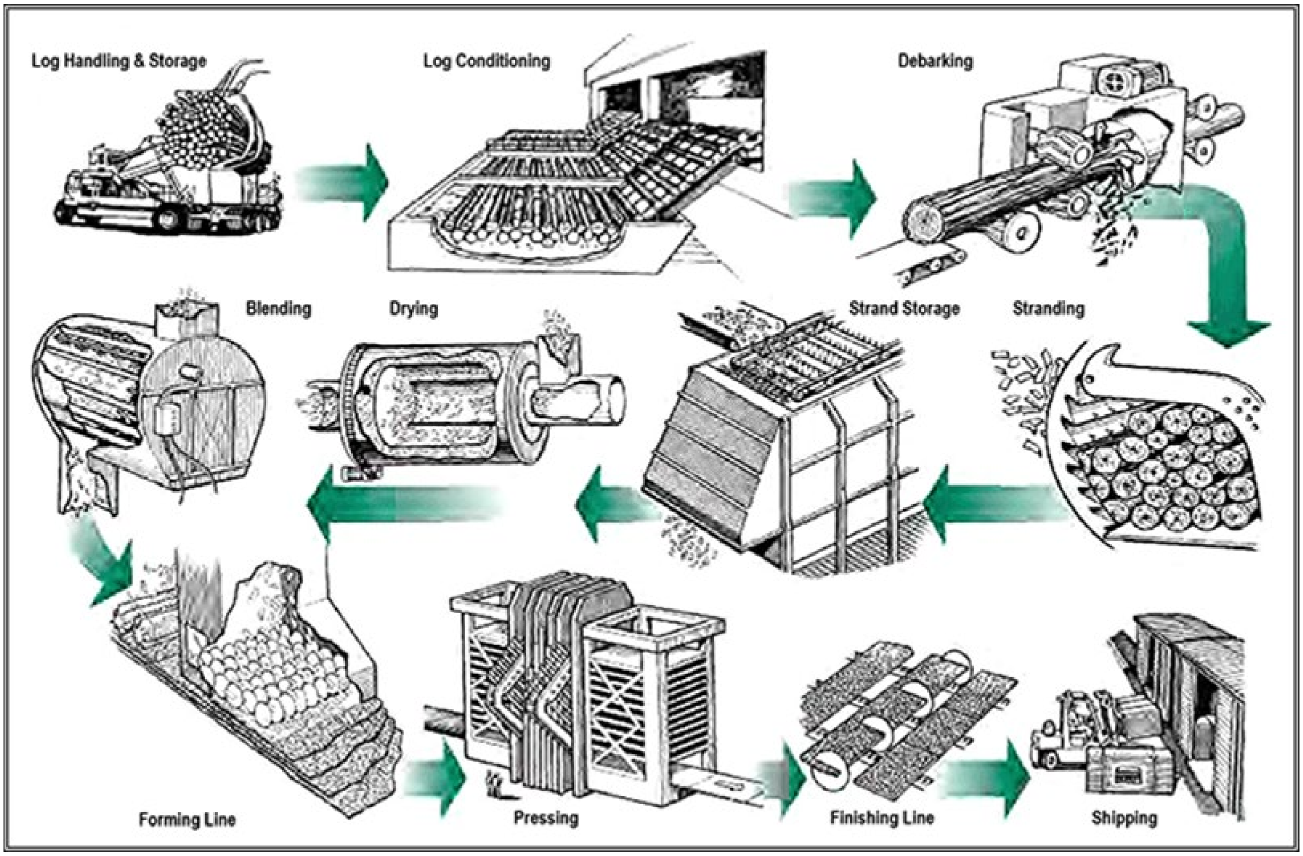


Figure 1. Flow diagram of the Production Process of Oriented Strand Board [10].

Table 5. Description of the Production Flow of OSB and the Associated Inputs and Outputs of each Unit Process.

Production Step	Description	Inputs	Outputs
Debarking	Includes log yard storage, sorting on the log yard; bucking (cutting logs to shorter *bolts*) and debarking.	Roundwood Diesel (log handlers) Electricity	Debarked bolts Bark and wood waste
Stranding	Bolts are cut parallel to the grain using an electrically-powered, multi-knife ring flaker to produce thin (mm) *strands* about 6 inches long and 1 inch wide.	Debarked bolts Electricity	Green (undried) strands
Drying	Green strands are passed through rotating driers heated with wood combustion exhaust and possibly natural gas to 4-8% moisture content.	Green strands Wood fuel (bark, screen fines, trimmings) Natural gas	Dry strands Air emissions, including particulates and volatile organic compounds (VOC)
Screening	*Fines,* wood pieces that are too small for OSB production, pass the screen and removed for use as fuel. Strands retained on the screen are used for OSB production.	Dry flakes Electricity	Dry strands of appropriate dimensions Fines
Blending	Stands are mechanically mixed with adhesives (adhesives) and wax to create the *furnish.*	Dry, screened strands Adhesive (pMDI, PF) Wax Electricity	Blended furnish
Forming	The furnish is deposited in three perpendicular layers to form a thick mat.	Blended furnish Electricity	Formed mat Air emissions, including VOC and hazardous air pollutants (HAP)
Pressing	The formed mat is heated and compressed in a (multiple-opening or continuous) press to achieve the final thickness and to cure the resin.	Formed mat Thermal energy (press) Electricity	Rough OSB Air emissions (VOC and HAP)
Finishing	Rough OSB sheets are trimmed, cooled, cut to size, stamped, stacked and packaged for shipment.	Rough OSB Electricity Fuel for forklifts Packaging materials	Packaged OSB Wood waste (trimmings) Air emissions (VOC and HAP)

Packing materials represent only 0.47 percent of the mass of the main product. The wood stickers and runners make up the bulk of the mass, representing 89 percent of the total packaging. The wrapping materials represent 9 percent and strapping and cardboard at 3 percent of the total packaging mass.

Methodological Framework

The underlying LCA [16] was performed in conformance with ISO 14040/44 [7,8], ISO 21930 [9] and EN15804 [5], as well as the PCR.

Type of EPD and Life Cycle Stages

This EPD is intended to represent an industry wide life cycle assessment (LCA) for OSB in the U.S. Twenty-three facilities contributed production data, resource use, energy and fuel use, transportation distances, and onsite processing emissions. These data were weighted average based on production to produce the life cycle inventory data for the life cycle impact assessment (LCIA). The underlying LCA [16] investigates OSB production from cradle-to-gate. Information modules included in the LCA are shown in Table 6. This EPD includes mandatory modules A1-A3 for a cradle-to-gate analysis.

Table 6. Life Cycle Stages & Information Modules per ISO 21930.

PRODUCTION STAGE			CONSTRUCTION STAGE		USE STAGE							END-OF-LIFE STAGE				OPTIONAL BENEFITS
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Extraction and up-stream production	Transport to factory	Manufacturing	Transport to site	Installation	Use	Maintenance	Repair	Replacement	Refurbishment	Building Operational Energy Use During Product Use	Building Operational Water Use During Product Use	Deconstruction	Transport	Waste	Disposal	Reuse, Recycle, & Recovery benefits
X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND

System Boundaries and Product Flow Diagram

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

A1 - RAW MATERIAL EXTRACTION	A1 includes the cradle to gate forestry operation [13,14] that may 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. A1 includes the cradle to gate resin production data [3]
A2 - RAW MATERIAL TRANSPORT	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 OSB including energy consumption and fuel use, resource use, water use, emissions to air and water, waste disposal, and packaging. Packaging materials represent less than one percent (0.47%) of the mass of the main product. The packaging is allocated 100 percent to OSB.

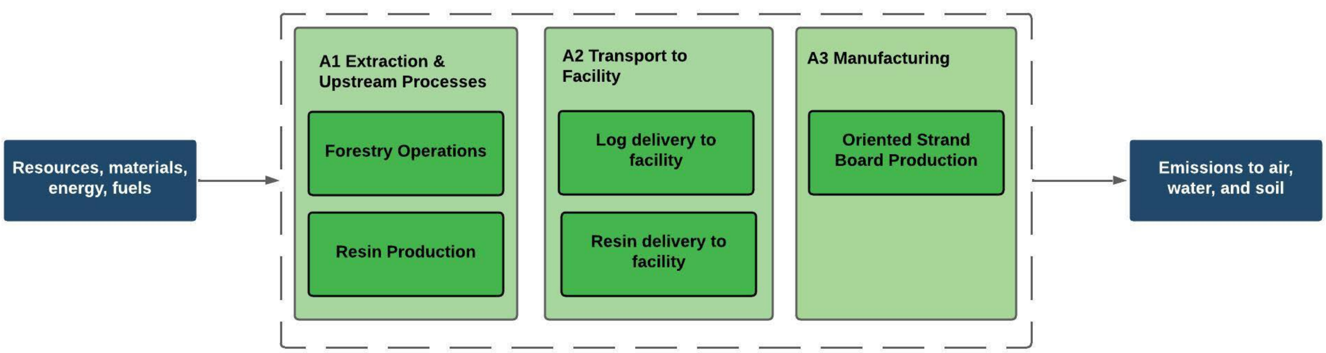


Figure 2. Cradle-to-Gate (A1-A3) System Boundary for Oriented Strand Board Production.

Declared Unit

The declared product consists of hardwoods (16%) and softwoods (83%). The percent composition is shown in Table 7.

Table 7. Product Composition.

Product Component	Percentage of Declared Product
Softwood/Hardwood Strands	96.33%
Adhesives	3.67%

Allocation Methods

Allocation is the method used to partition the environmental load of a process when several products or functions share the same process. The input material for producing OSB is a round log with bark. Processing the log involves multiple steps with generation of by-products (e.g., sawdust, chips, bark). Following the PCR (UL 2018, 2020) and ISO 21930:2017, allocation is based on physical properties (e.g., mass or volume). For this study, a mass allocation was achieved for the primary product and subsequent by-products. Some by-products used internally were used for on-site energy generation. Packaging inputs are not related to the by-products and are allocated 100% to the final product.

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 2020.

Third party verified ISO [6,7,8] secondary LCI data sets contribute 61-100% of total impact to any of the required impact categories identified by the applicable PCR [17,18].

Treatment of Biogenic Carbon

Biogenic carbon emissions and removals are reported in accordance with ISO 21930 7.2.7. and 7.2.12. ISO 21930 requires a demonstration of forest sustainability to characterize carbon removals with a factor of -1 kg CO_2eq/kg CO_2. 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 CO_2eq/kg CO_2.

Environmental Parameters Derived from the LCA

The impact categories and characterization factors 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 v1.08 [4]. The total primary energy consumption is tabulated from the LCI results based on the Cumulative Energy Demand Method (CED, LHV, V1.0) published by Ecoinvent [19]. 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 9.6 [15] was used to organize and accumulate the LCI data, and to calculate the LCIA results (Table 8).

Table 8. Selected Impact Category Indicators and Inventory Parameters.

Core Mandatory Impact Indicator	Abbreviation	Units	Method
Global warming potential, Total	GWP_{TOTAL}	kg CO_2e	$GWP_{BIOGENIC} + GWP_{FOSSIL}$
Global warming potential, Biogenic	$GWP_{BIOGENIC}$	kg CO_2e	TRACI 2.1 V1.08+ LCI Indicatory
Global warming potential, Fossil	GWP_{FOSSIL}	kg CO_2e	TRACI 2.1 V1.08
Depletion potential of the stratospheric ozone layer	ODP	kg CFC11e	TRACI 2.1 V1.08
Acidification potential of soil and water sources	AP	kg SO_2e	TRACI 2.1 V1.08
Eutrophication potential	EP	kg PO_4e	TRACI 2.1 V1.08
Formation potential of tropospheric ozone	SFP	kg O_3e	TRACI 2.1 V1.08
Abiotic depletion potential (ADP fossil) for fossil resources;	ADPf	MJ, LHV	CML-IA Baseline V3.08
Fossil fuel depletion	FFD	MJ Surplus	TRACI 2.1 V1.08
Use of Primary Resources			
Renewable primary energy carrier used as energy	RPRE	MJ, LHV [a/]	CED (LHV) V1.00
Renewable primary energy carrier used as material	RPRM	MJ, LHV	LCI Indicator
Non-renewable primary energy carrier used as energy	NRPRE	MJ, LHV	CED (LHV) V1.00
Renewable primary energy carrier used as material	NRPRM	MJ, LHV	LCI Indicator
Secondary material, secondary fuel and recovered energy			
Secondary material	SM	kg	LCI Indicator
Renewable secondary fuel	RSF	MJ, LHV	LCI Indicator
Non-renewable secondary fuel	NRSF	MJ, LHV	LCI Indicator
Recovered energy	RE	MJ, LHV	LCI Indicator
Mandatory Inventory Parameters			
Consumption of freshwater resources;	FW	m^3	LCI Indicator
Indicators Describing Waste			
Hazardous waste disposed	HWD	kg	LCI Indicator
Non-hazardous waste disposed	NHWD	kg	LCI Indicator
High-level radioactive waste, conditioned, to final repository	HLRW	m^3	LCI Indicator
Intermediate- and low-level radioactive waste, conditioned, to final repository	ILLRW	m^3	LCI Indicator
Components for re-use	CRU	kg	LCI Indicator
Materials for recycling	MR	kg	LCI Indicator
Materials for energy recovery	MER	kg	LCI Indicator
Recovered energy exported from the product system	EE	MJ, LHV	LCI Indicator
Additional Inventory Parameters			
Biogenic Carbon Removal from Product	BCRP	kg CO_2	LCI Indicator
Biogenic Carbon Emission from Product	BCEP	kg CO_2	LCI Indicator
Biogenic Carbon Removal from Packaging	BCRK	kg CO_2	LCI Indicator
Biogenic Carbon Emission from Packaging	BCEK	kg CO_2	LCI Indicator
Biogenic Carbon Emission from Combustion of Waste from Renewable Sources Used in Production	BCEW	kg CO_2	LCI Indicator

Life Cycle Impact Assessment Results

Tables 9-11 present the cradle-to-gate (A1-A3) LCIA and LCI parameter results for the declared unit of one m^3 of OSB. No permanent carbon storage is included in the cradle-to-gate (A1-A3) results. As a result, the biogenic carbon balance for the cradle-to-gate portion of the life cycle is net neutral. Cradle-to-gate results for OSB on a relative basis are presented in Tables 12-13 and Figure 3.

Table 9. Cradle-to-Gate LCIA Results for 1 m^3 of Oriented Strand Board – Absolute Basis.

Core Mandatory Impact Indicator	Total	A1	A2	A3
GWP_{TOTAL} [kg CO_2 eq]	211.02	(1,505.18)	21.57	1,694.64
$GWP_{BIOGENIC}$ [kg CO_2 eq]	0.00	(1,571.29)	0.00	1,571.29
GWP_{FOSSIL} [kg CO_2 eq]	211.02	66.10	21.57	123.35
ODP [kg CF-11eq]	4.71E-06	3.82E-06	3.80E-08	8.51E-07
AP [kg SO_2 eq]	0.9391	0.4535	0.1191	0.3665
EP [kg N eq]	0.4418	0.1207	0.0096	0.3116
SFP [kg O_3 eq]	22.05	8.92	3.44	9.70
FFD [MJ, surplus]	452.25	193.75	40.51	218.00
ADP_{FOSSIL} [MJ, LHV]	3,067.82	1,421.42	269.82	1,376.59

Table 10. Cradle-to-Gate Resource Use Results for 1 m^3 of Oriented Strand Board – Absolute Basis.

Use of Primary Resources	Total	A1	A2	A3
RPRE [MJ, LHV]	4,032.58	16.29	0.62	4,015.67
RPRM [MJ, LHV]	16,301.56	16,301.56	0.00	
NRPRE [MJ, LHV]	3,871.76	1,464.13	273.77	2,133.85
NRPRM [MJ, LHV]	793.51	793.51	0.00	0.00
SM [kg]	0.00	0.00	0.00	0.00
RSF [MJ, LHV]	0.00	0.00	0.00	0.00
NRSF [MJ, LHV]	0.00	0.00	0.00	0.00
RE [MJ, LHV]	0.00	0.00	0.00	0.00
FW [m^3]	0.5191	0.2053	0.0005	0.3133

Table 11. Cradle-to-Gate Output Flows for 1 m^3 of Oriented Strand Board – Absolute Basis

Indicators Describing Waste	Total	A1	A2	A3
HWD [kg]	2.84E-01	2.71E-01	1.72E-04	1.24E-02
NHWD [kg]	1.03E+01	2.59E+00	1.95E+00	5.81E+00
HLRW [m^3]	5.08E-07	1.89E-09	2.14E-09	5.04E-07
ILLRW [m^3]	6.75E-06	5.86E-08	1.88E-08	6.67E-06
CRU [kg]	0.00	0.00	0.00	0.00
MR [kg]	0.00	0.00	0.00	0.00
MER [kg]	0.00	0.00	0.00	0.00
EE [MJ, LHV]	0.00	0.00	0.00	0.00

Table 12. Cradle-to-Gate LCIA Results for 1 m^3 of Oriented Strand Board – Relative Basis.

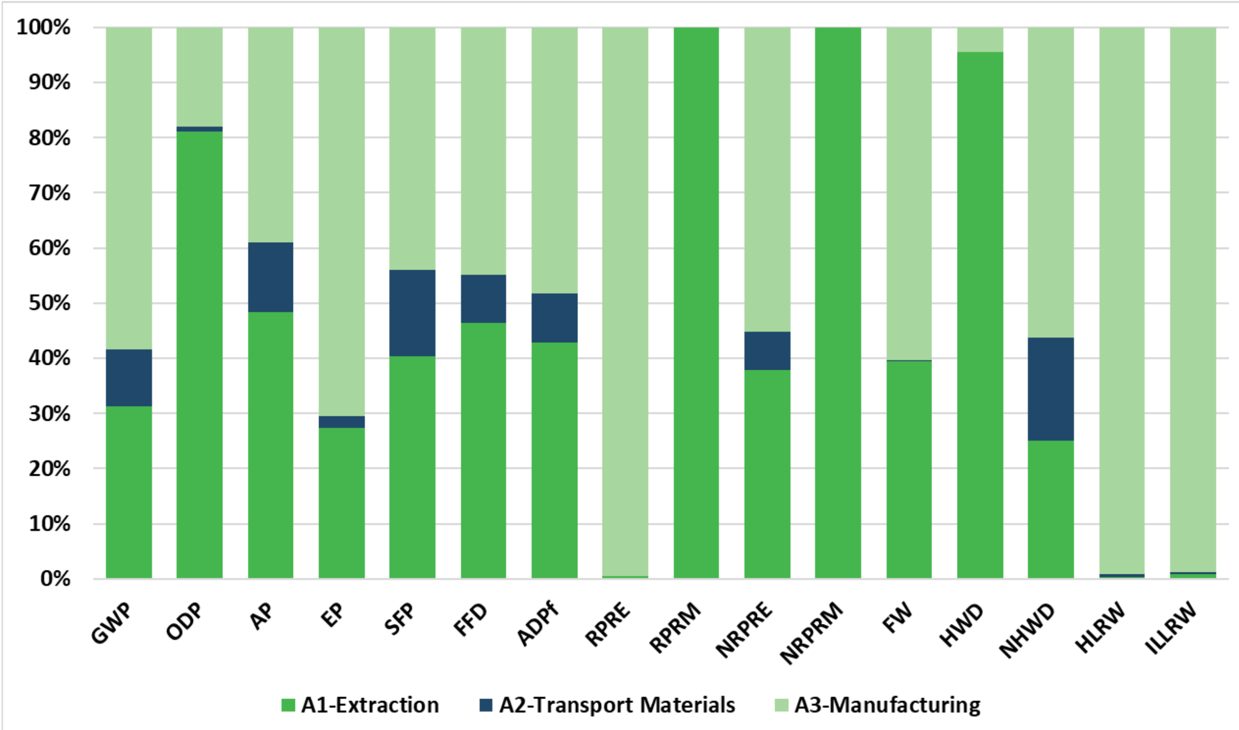
Core Mandatory Impact Indicator	Total	A1	A2	A3
GWP_{FOSSIL} [kg CO_2 eq]	100%	31.3%	10.2%	58.5%
ODP [kg CF-11eq]	100%	81.1%	0.8%	18.1%
AP [kg SO_2 eq]	100%	48.3%	12.7%	39.0%
EP [kg N eq]	100%	27.3%	2.2%	70.5%
SFP [kg O_3 eq]	100%	40.4%	15.6%	44.0%
FFD [MJ, surplus]	100%	46.3%	8.8%	44.9%
ADP_{FOSSIL} [MJ, LHV]	100%	42.8%	9.0%	48.2%

Table 13. Cradle-to-Gate Resource Use Results for 1 m^3 of Oriented Strand Board – Relative Basis.

Use of Primary Resources	Total	A1	A2	A3
RPRE [MJ, LHV]	100%	0.4%	0.0%	99.6%
RPRM [MJ, LHV]	100%	100.0%	0.0%	0.0%
NRPRE [MJ, LHV]	100%	37.8%	7.1%	55.1%
NRPRM [MJ, LHV]	0%	100.0%	0.0%	0.0%
FW [m^3]	100%	39.5%	0.1%	60.4%

Table 14. Cradle-to-Gate Output Flows for 1 m^3 of Oriented Strand Board – Relative Basis.

Indicators Describing Waste	Total	A1	A2	A3
HWD [kg]	100%	95.6%	0.1%	4.4%
NHWD [kg]	100%	25.0%	18.8%	56.2%
HLRW [m^3]	100%	0.4%	0.4%	99.2%
ILLRW [m^3]	100%	0.9%	0.3%	98.9%



GWP	Global warming potential
ODP	Depletion potential of the stratospheric ozone layer
AP	Acidification potential of soil and water sources
EP	Eutrophication potential
SFP	Formation potential of tropospheric ozone
ADPf	Abiotic depletion potential (ADP fossil) for fossil resource
FFD	Fossil fuel depletion
RPRM	Renewable primary energy carrier used as energy
RPRM	Renewable primary energy carrier used as material.
NRPE	Non-renewable primary energy carrier used as energy.
NRPRM	Renewable primary energy carrier used as material.
FW	Consumption of freshwater resources
HWD	Hazardous waste disposed.
NHWD	Non-hazardous waste disposed.
HLRW	High-level radioactive waste, conditioned, to final repository
ILLRW	Intermediate- and low-level radioactive waste, conditioned to final repository

Figure 3. Cradle-to-Gate LCIA Results for the Production Oriented Strand Board – Relative Basis.

Biogenic Carbon Results

Cradle-to-Gate Results

Wood is a biobased material and thus contains biogenic carbon. The accounting of biogenic carbon follows the requirements set out in ISO 21930:2017 where biogenic carbon enters the product system (removal) as primary or secondary material. Carbon removal is considered a negative emission. The biogenic carbon leaves the system (emission) as a product, by-products, or directly to the atmosphere when combusted for heat energy. These mass flows of biogenic carbon from and to nature are listed in the LCI and are expressed in kg CO_2.

Table 15 shows the biogenic carbon removal and emissions. All carbon dioxide flows (kg CO_2) presented in Table 15 are unallocated to include by-products leaving the system boundary in module A3. Even though the system boundary for this LCA only includes module A1-A3, in accordance with ISO 21930, emission from packaging (BCEK) is reported in A5-Construction and emission from the main product (BCEP) is reported in C3/C4-End-of-Life[1]. The net carbon emission across the cradle-to-gate life cycle is zero. It is assumed that all carbon removed from the atmosphere is eventually emitted to the atmosphere as CO_2.

Table 15. Biogenic Carbon Inventory Parameters for 1 m^3 of Oriented Strand Board, Unallocated.

	A1	A2	A3	A5	C3/C4	Total
BCRP [kg CO_2]	(1,576.67)	0.00	0.00	0.00	0.00	(1,576.67)
BCEP [kg CO_2]	0.00	0.00	97.96	0.00	1,193.28	1,291.24
BCRK [kg CO_2]	0.00	0.00	(5.38)	0.00	0.00	(5.38)
BCEK [kg CO_2]	0.00	0.00	0.00	5.38	0.00	5.38
BCEW [kg CO_2]	0.00	0.00	280.06	0.00	0.00	280.06

[1] These products are reported in modules outside the scope of this LCA system boundary to provide reference for EoL waste and emissions if a full cradle-to-grave LCA were to be performed.

Cradle-to-Grave Results

The product system represented in this EPD includes the information modules 'A1 Extraction and upstream production', 'A2 Transport to factory' and 'A3 Manufacturing'. As per ISO 21930, the net biogenic carbon emissions across the reported modules are zero (carbon neutral). This conservative assumption excludes the permanent sequestration of biogenic carbon if the LCA were to consider the typical end-of-life treatment for wood products, landfilling.

UL Environment published an addendum to the reference PCR that estimates the emissions from landfilling of wood products (UL 2020 Appendix A). The carbon sequestration addendum 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. Because the end-of-life fate of this material is unknown, we have applied the default disposal pathway from the PCR Part A (UL 2018) Section 2.8.5, 100% landfill.

The following results apply the addendum methodology (UL 2020 Appendix A) to the biogenic carbon present in the primary product as it leaves the manufacturer in Module A3[2].

1 m^3 softwood OSB = 650.88 oven dry kg = 325.44 kg carbon = 1,193.28 kg CO_2 eq

Carbon sequestered in product at manufacturing gate:
1,193.28 kg CO_2 eq = -1,193.28 kg CO_2 eq

Methane emitted from fugitive landfill gas:
2.30 kg CH_4 = 57.56 kg CO_2 eq emission[3]

Carbon dioxide emitted from fugitive landfill gas and the combustion captured landfill gas:
134.08 kg CO_2 eq emission[4]

Permanent carbon sequestration, net of biogenic carbon emissions:
1,001.64 kg CO_2 eq = -1,001.64 kg CO_2 eq emission[5]

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[2] Background assumptions for EoL and 100% Landfill: methane emission = 3.53E-03 kg CH4/kg dry wood; carbon dioxide emission = 2.06E-01 kg CO2/kg dry wood (UL 2020).

[3] Methane emissions= 3.53E-03 kg CH4/kg of dry wood X 650.88 kg of dry wood = 2.30 kg CH4; kg CO2 eq = 2.30 kg CH4 X 25.05 kg CH4/kg CO2 eq = 57.56 kg CO2 eq

[4] Carbon dioxide emissions= 2.06E-01 kg CO2/kg of dry wood X 650.88 = 134.08 kg CO2

[5] Final sequestration, net of biogenic emissions = CO2 eq in product at gate = 1,193.28 – (57.56 + 134.08) = 1,001.64 kg CO2 eq

LCA Interpretation

Comparability

Environmental declarations from different programs [6] 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 different results for upstream or downstream of the life cycle stages declared.

Limitations

This LCA was created using manufacturer average data for upstream materials. Variation can result from differences in supplier locations, manufacturing processes, manufacturing efficiency and fuel type used. This LCA does not report all of the environmental impacts due to manufacturing of the product but rather reports the environmental impacts for those categories with established LCA-based methods to track and report. Unreported environmental impacts include (but are not limited to) factors attributable to human health, land use change, and habitat destruction. In order to assess the local impacts of product manufacturing, additional analysis is required.

Additional Environmental Information

According to ISO 21930 section 9.6, a manufacturer is required to report hazardous and/or dangerous substances. Drying and pressing processes contribute to the production of emissions during OSB manufacturing. Mills classed as major sources under EPA rules are required to report methanol, formaldehyde, phenol, acetaldehyde, propionaldehyde, and acrolein which are on the US Environmental Agency (EPA) Toxics Release Inventory. These emissions are reported in this EPD.

Oriented strand board production facilities obtain their wood fiber from sources that are legally and sustainably sourced. Participating facilities reported Fiber Sourcing data for the three sourcing categories established in ASTM-D7612-21: Standard Practice for Categorizing Wood and Wood-Based Products According to Their Fiber Sources [2]. The standard provides criteria for differentiating wood products into three categories:

1. Non-controversial Sources of Forest Products,
2. Responsible Sources of Forest Products, and
3. Certified Sources of Forest Products.

Fiber from non-controversial, or legal, sources are from geographic areas with a low risk of illegal activity and are compliant with legal or other proprietary standards. Products from responsible sources are produced with wood fiber acquired according to an independently certified procurement standard or are from jurisdictions with regulatory or quasi-regulatory programs to implement best management practices. Independently certified procurement standards include FSC Controlled Wood and SFI Fiber Sourcing. To qualify for either standard, an OSB mill must have a system in place that verifies their logs are coming from areas in compliance with forestry best management practices to protect air and water quality and ensure all fiber comes from known and legal sources. Products from certified sources are independently certified to an internationally recognized forest management certification standard, such as those from the

Sustainable Forestry Initiative (SFI), Forest Stewardship Council (FSC), Programme for the Endorsement of Forest Certification (PEFC), American Tree Farm System (ATFS), or the Canadian Standards Association (CSA).

The twenty-three facilities represented in this LCA reported on average,100% of the fiber entering their mills to be non-controversial (legal), 95.7% to be responsible (following a certified procurement standard), and 18.4% from independently certified forests.

Forest Management

While this EPD does not address landscape level forest management impacts that influence forest carbon, wildlife habitat, endangered species, and soil and water quality, these potential impacts may be addressed through requirements put forth in regional regulatory frameworks, ASTM 7612-21 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.

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 product line and reported impact when averaging data.

Photo credits
APA: pages: 9, 11, 14 (middle top and right), 16, 21

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