Environmental Product Declaration

Western Red Cedar Lumber

This Type III environmental declaration is developed according to ISO 21930 and 14025 for average cedar lumber manufactured by the members of the Western Red Cedar Lumber Association. This environmental product declaration (EPD) reports environmental impacts based on established life cycle impact assessment (LCIA) 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 of related to resource extraction or toxic effects of products on human health of product systems. 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. The products in this EPD conform to: regulations of BC and forest certification schemes (Canadian Standard Association, Sustainable Forestry initiative (SFI), and Forest Stewardship Council (FSC)). EPDs do not report product environmental performance against any benchmark.

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WESTERN RED CEDAR LUMBER ASSOCIATION
REALCEDAR
WRCLA

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Manufacturer Information

This EPD addresses products from multiple manufacturers and represents an average for the membership of the Western Red Cedar Lumber Association (WRCLA), a non-profit trade association representing manufacturers of western red cedar products. This average is based on a sample that included two lumber mills in British Columbia (BC). The total data represents 13% of western red cedar lumber production in the year 2014. These data are combined with Athena Sustainable Materials Institute western red cedar resource extraction inventory updated using recent in-house coastal harvesting data, a survey of cedar nursery production in BC, and CORRIM (The Consortium for Research on Renewable Industrial Materials) forest management data.

Product Description

Western Red Cedar rough lumber is remanufactured into various dimensions, profiles and grades of Western Red Cedar finished products.

Product composition of one thousand board feet of (mfbm) of green lumber at the mill gate:

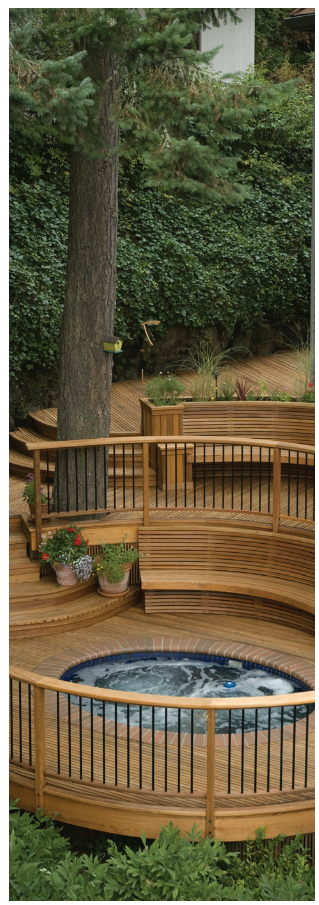
- Wood fibre: 592.2 kg on oven dry basis

Scope: Cradle-to-gate.

Declared unit: One thousand board feet (1 mfbm) of rough green lumber at mill gate

System boundary: Life cycle activities from resource extraction, transportation and processing through product (lumber) manufacture.

Geographic boundary: North America.



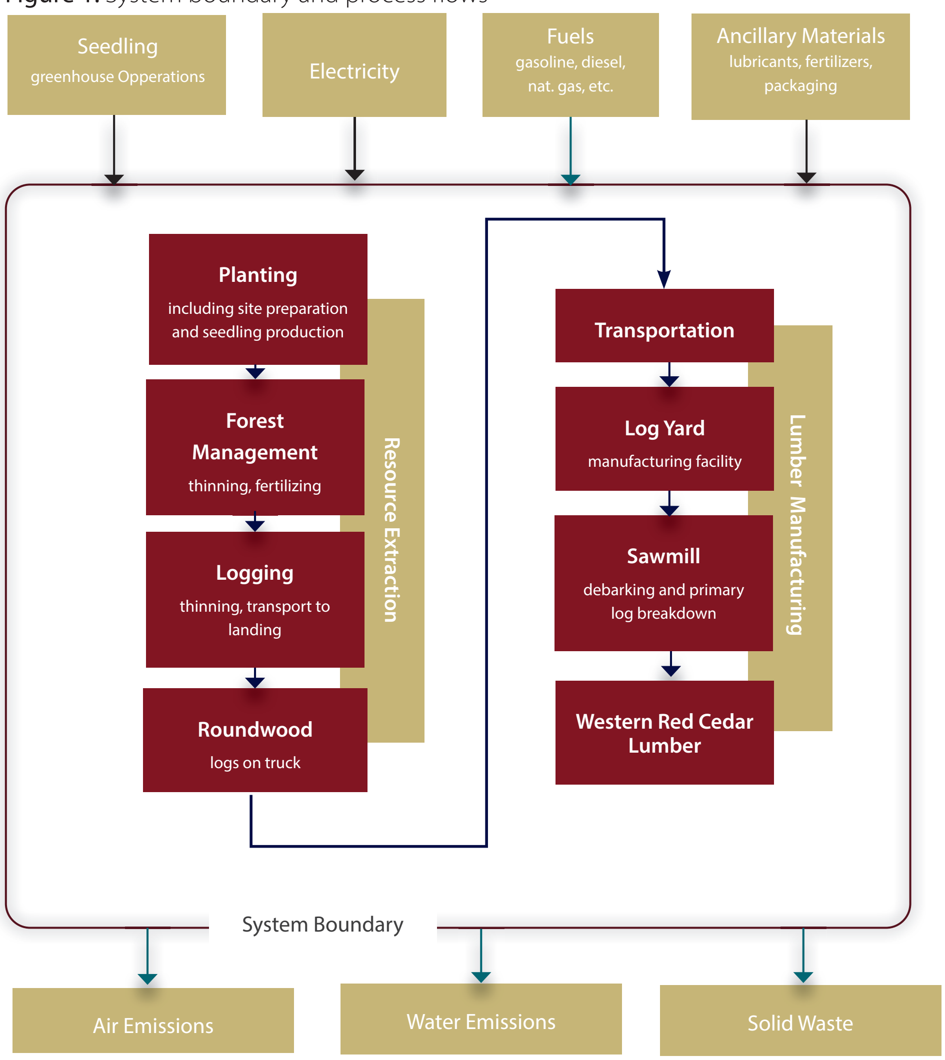
Life Cycle Assessment

Life cycle assessment (LCA) is a rigorous study of inputs and outputs over the entire life of a product or process and the associated environmental impact of those flows to and from nature. The underlying LCA supporting this EPD was performed by FPInnovations in 2016 and was third-party peer-reviewed by James Salazar at Coldstream Consulting. The LCA study collected primary data from western cedar lumber operations in 2015 for the production year 2014.

The system boundary includes all the production steps from extraction of raw materials from the earth (the cradle) through to final product at the mill gate. See Figure 1. The boundary includes the transportation of major inputs to, and within, each activity stage.

Ancillary materials such as hydraulic fluids, lubricants and packaging are included in the boundary. Mass or energy flows are excluded if they account for less than 1% of model flows and less than 2% of life cycle impacts in all categories. Human activity, capital equipment and land use are excluded.

Figure 1. System boundary and process flows



Environmental Performance

Environmental impacts were calculated using TRACI (Tool for the Reduction and Assessment of Chemical and other Environmental Impacts) version 2.1 – the life cycle impact assessment methodology developed by the U.S. Environmental Protection Agency. Energy and material resource consumption, waste and impact indicator results are presented in Table 1, and 2. Impact indicators used are global warming potential (GWP), acidification potential, eutrophication potential, smog potential, and ozone depletion potential. The LCA model is designed to track all carbon fluxes in the GWP measure: the carbon stored in lumber and all carbon emissions, including those from biomass combustion throughout the cradle-to-gate life cycle. A summary of the carbon balance at each life cycle stage is depicted in Table 4.

Lumber manufacturing generates multiple products that provide revenue: the main product (lumber) and co-products (bark, sawdust and pulp chips). Allocation of environmental burdens to cedar lumber and its co-products is done according to economic allocation principles.

Table 1: Environmental performance of WRC rough green lumber on one thousand board feet basis, by life cycle stage

Indicator	Unit	Total	Resource extraction	Transport	Sawmilling
Energy consumption					
Total primary energy:	MJ eq.	1499.83	316.83	336.33	846.67
Non-renewable, fossil	MJ eq.	845.85	302.64	319.70	223.51
Non-renewable, nuclear	MJ eq.	15.85	0.11	13.93	1.81
Renewable, biomass	MJ eq.	1.23	0.01	0.90	0.33
Renewable, (SWHG)	MJ eq.	636.90	14.07	1.80	621.03
Feedstock energy, renewable	MJ eq.	13,360.03			13,360.03
Environmental impacts					
Global warming potential (GWP)	kg CO_2 eq.	56.38	19.87	24.64	11.86
Acidification potential	kg SO_2 eq.	16.25	7.09	6.47	2.69
Eutrophication potential	kg N eq.	0.63	0.25	0.23	0.14
Smog potential	kg O_3 eq.	0.06	0.01	0.03	0.01
Ozone depletion potential	kg CFC-11 eq.	4.36E-06	3.10E-08	3.26E-06	1.07E-06
Material resources and fresh water consumption					
Renewable material consumption (wood)	kg	20.72	0.04	20.52	0.17
Non- renewable material consumption (clay and shale, coal, coarse aggregate, crude oil, gypsum, iron ore, limestone, natural gas, sand, metal, uranium, etc.)	kg	1292.97	1292.97	0.00	9.68E-04
Freshwater use	l	76.19	0.58	70.00	5.61
Waste					
Hazardous	kg	0.00	0.00	0.00	0.00
Non-hazardous (wood waste, wood ash and other solid waste)	kg	135.27	45.27	0.00	90.00

**SWHG: Solar, wind, hydroelectric and geothermal*

Table 2: Environmental performance of WRC rough green lumber on one cubic meter basis, by life cycle stage

Indicator	Unit	Total	Resource extraction	Transport	Sawmilling
Energy consumption					
Total primary energy:	MJ eq.	833.24	176.02	186.85	470.37
Non-renewable, fossil	MJ eq.	469.92	168.13	177.61	124.17
Non-renewable, nuclear	MJ eq.	8.81	0.06	7.74	1.01
Renewable, biomass	MJ eq.	0.69	4.91E-03	0.50	0.18
Renewable, (SWHG*)	MJ eq.	353.83	7.82	1.00	345.01
Feedstock energy, renewable	MJ eq.	7422.24			7422.24
Environmental impacts					
Global warming potential (GWP)	kg CO_2 eq.	31.32	11.04	13.69	6.59
Acidification potential	kg SO_2 eq.	0.35	0.14	0.13	0.08
Eutrophication potential	kg N eq.	0.03	0.01	0.02	0.00
Smog potential	kg O_3 eq.	9.03	3.94	3.60	1.49
Ozone depletion potential	kg CFC-11 eq.	2.42E-06	1.72E-08	1.81E-06	5.97E-07
Material resources and fresh water consumption					
Renewable material consumption (wood)	kg	11.51	0.02	11.40	0.09
Non- renewable material consumption (clay and shale, coal, coarse aggregate, crude oil, gypsum, iron ore, limestone, natural gas, sand, metal, uranium, etc.)	kg	718.32	718.32	0.00	5.38E-04
Freshwater use	l	43.44	0.32	40.00	3.12
Waste					
Hazardous	kg	0.00	0.00	0.00	0.00
Non-hazardous (wood waste, wood ash and other solid waste)	kg	75.15	25.15	0.00	50.00

**SWHG: Solar, wind, hydroelectric and geothermal*

Glossary

Primary Energy Consumption

Primary energy is the total energy consumed by a process including upstream losses during energy production and delivery. Energy is reported in megajoules (MJ).

Global Warming Potential

This impact category refers to the potential change in the earth's energy balance due to the accumulation of greenhouse gases which block long wave radiation that would otherwise have passed out of the earth's atmosphere. Greenhouse gas refers to several different gases including carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). For global warming potential, greenhouse gases are tracked and their impact is reported in units of CO_2 equivalents (eq).

Acidification Potential

Acidification refers to processes that increase the acidity of water and soil systems as measured by hydrogen ion concentrations (H^+) and are often manifested as acid rain. Damage to plant and animal ecosystems can result, as well as corrosive effects on buildings, monuments and historical artifacts. Atmospheric emissions of nitrogen oxides (NO_x) and sulphur dioxide (SO_2) are two key substances contributing to acidification potential. Acidification potential is reported in kg of SO_2 equivalents.

Eutrophication Potential

Eutrophication is the fertilization of surface waters by nutrients that were previously scarce, leading to a proliferation of aquatic photosynthetic plant life which may then lead to further consequences including foul odor or taste, loss of aquatic life, or production of toxins. Eutrophication is caused by excessive emissions to water of phosphorus (P) and nitrogen (N). This impact category is reported in units of N equivalent.

Smog Potential

Photochemical smog is the chemical reaction of sunlight, nitrogen oxides (NO_x) and volatile organic compounds (VOCs) in the lower atmosphere. Ground-level ozone is an indicator, and NO_x emissions are a key driver in the creation of ground-level ozone. This impact indicator is reported in units of O_3 equivalent.

Ozone Depletion Potential

This impact category addresses the reduction of protective ozone within the upper atmosphere caused by emissions of ozone-depleting substances such as chlorofluorocarbons (CFCs). Reduction in ozone in the stratosphere leads to increased ultraviolet-B radiation reaching earth, which can have human health impacts as well as damage crops, materials and marine life. Ozone depletion potential is reported in units of CFC-11 equivalent.

Source: *Bare et al, 2003*

Freshwater Consumption

Use of freshwater when release into the original watershed does not occur because of evaporation, product integration, or discharge into different watersheds, or the sea.

Table 3: Environmental impacts calculated using CML 2 baseline 2000 method and energy consumption on one cubic meter of lumber basis, by life cycle

Impact category:	Unit	Total	Resource Extraction	Transport	Lumber Manufacturing
Abiotic depletion	kg Sb eq.	4.68E-06	7.05E-08	3.00E-06	1.61E-06
Abiotic depletion (fossil fuels)*	kg Sb eq.	0.19	0.07	0.08	0.04
Global warming (GWP100a)	kg CO_2 eq.	31.31	11.04	13.68	6.59
Ozone layer depletion (ODP)	kg CFC-11 eq.	1.88E-06	1.44E-08	1.35E-06	5.15E-07
Human toxicity	kg 1,4-DB eq.	12.96	8.33	1.59	3.04
Fresh water aquatic ecotoxicity	kg 1,4-DB eq.	5.17	2.96	1.05	1.17
Marine aquatic ecotoxicity	kg 1,4-DB eq.	19044.66	10987.63	3807.86	4249.17
Terrestrial ecotoxicity	kg 1,4-DB eq.	0.01	2.18E-04	4.36E-03	7.55E-04
Photochemical oxidation	kg C_2H_4 eq.	0.01	3.86E-03	2.21E-03	3.10E-03
Acidification	kg SO_2 eq.	0.29	0.11	0.10	0.08
Eutrophication	kg PO_4 eq.	0.05	0.02	0.02	0.01
Total renewable energy	MJ	478.72	168.19	185.35	125.18
Total non-renewable energy	MJ	354.52	7.82	1.50	345.19
Total energy	MJ	833.24	176.02	186.85	470.37

**Abiotic fuel conversion 4.81E-04 kg Sb/MJ*

Additional Environmental Information

Sustainable Forestry

Western red cedar lumber from WRCLA members come from forests that are independently certified as legal and sustainable.

Carbon Balance

The carbon that is part of the molecular composition of wood is derived from carbon dioxide removed from the atmosphere by the growing tree that produced the wood; this carbon is often a consideration in greenhouse gas calculations and carbon footprints for wood products. See Table 4 for cradle-to-gate carbon balance at each of the life cycle stage, i.e., the net carbon footprint per 1Mfbm of lumber, calculated considering the carbon contained in the wood (a negative number as carbon sequestering is a removal of atmospheric carbon dioxide) and the life cycle carbon emissions and removals from bioenergy (net zero), and carbon emissions from fossil fuel combustion (a positive number). Carbon dioxide sequestered in lumber is used as the starting point, and after accounting for carbon emissions at each of the stage, the final product, lumber leaving the mill gate still caries negative carbon balance, meaning that lumber has sequestered more carbon than cradle-to-gate carbon dioxide emissions. In other words, stored carbon in cedar lumber at the manufacturing gate is still available to mitigate carbon footprint of buildings.

Table 4: Carbon balance

	kg of CO_2 eq.	
	per 1Mfbm	per 1 m^2
Forest carbon uptake	-1119.14	-621.74
GWP harvesting from forests	19.87	11.04
Net carbon balance cradle-to-round wood at forest	-1099.27	-610.71
GWP transporting from forest to sawmill	24.64	13.69
Net carbon balance cradle-to-round wood at sawmill	-1074.63	-597.02
GWP decking manufacture	11.86	6.59
Net carbon balance cradle-to-decking	-1062.77	-590.43

**GWP: Global warming potential*

References

Bare, J. C., Norris, G. A, Pennington, D. W., and McKone, T. 2003. TRACI: *The Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts.* Journal of Industrial Ecology, Vol.6 No.3-4.

ISO 14025:2006. *Environmental labels and declarations – Type III environmental declarations. International Standards Organization.*

ISO 21930:2007. *Environmental labels and declarations – Sustainability in building construction. Environmental declaration of building products. International Standards Organization.*

Mahalle, L. 2016. *Life Cycle Assessment of Western Red Cedar Lumber, Decking and Siding. FPInnovations, Vancouver. http://www.fpinnovations.ca*

About this EPD

PCR: North American Structural and Architectural W1ood Products, Version 2.0 June 2015 prepared by FPInnovations and available at www.fpinnovations.ca. PCR Review was conducted by:

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Explanatory materials on the background LCA can be obtained from Western Red Cedar Lumber Association

Independant verification of the declaration and data, according to ISO 14025

☐ internal ☒ external

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EPDs from different programs may not be comparable. EPDs based on cradle-to-gate information modules using declared units shall not be used for comparisons.

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