Environmental Product Declaration

Typical Western Red Cedar Siding

This Type III environmental declaration is developed according to ISO 21930 and 14025 for average cedar siding products 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 (Forest Stewardship Council (FSC), Sustainable Forestry initiative (SFI)). EPDs do not report product environmental performance against any benchmark.

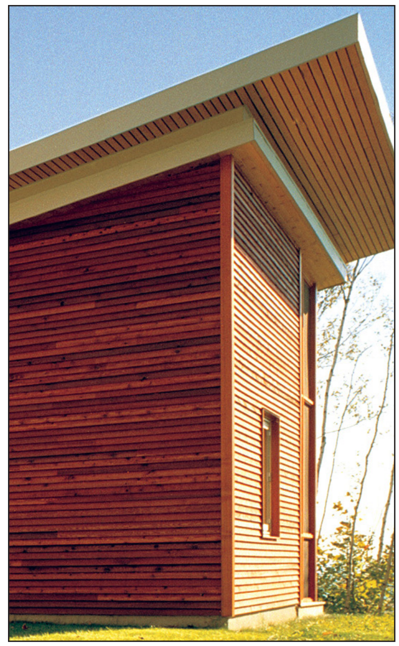
Issued June 2016
Valid until June 2021

WESTERN RED CEDAR LUMBER ASSOCIATION
REAL CEDAR
WRCLA

FPInnovations®

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 three remanufacturing mills (two in British Columbia (BC) and one in Washington, US), which represented 13% of industry production in 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

Wood siding is a board-type weatherproof product applied to a building as a final surfacing for exterior walls.

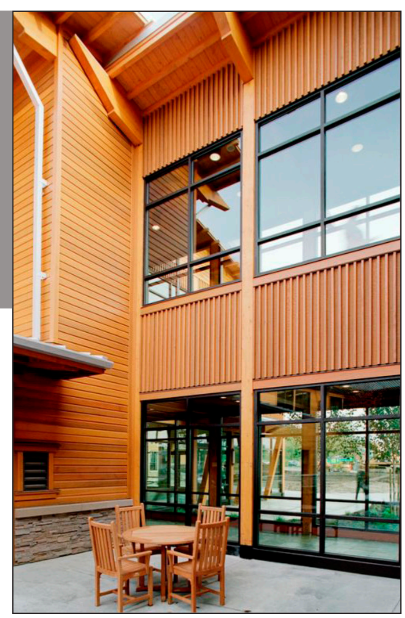
- Typical board size: 1" x 6" (19 mm x 140 mm)
- Product composition (on the basis of one thousand board feet of siding at mill gate):
  - Western red cedar lumber – 494 kg (oven dry basis)

Scope: Cradle-to-gate.

Declared unit: One thousand board feet (1 Mfbm) of siding at mill gate.

System boundary: Life cycle activities from resource extraction through final product ready for shipment at mill gate.

Geographic boundary: North America.



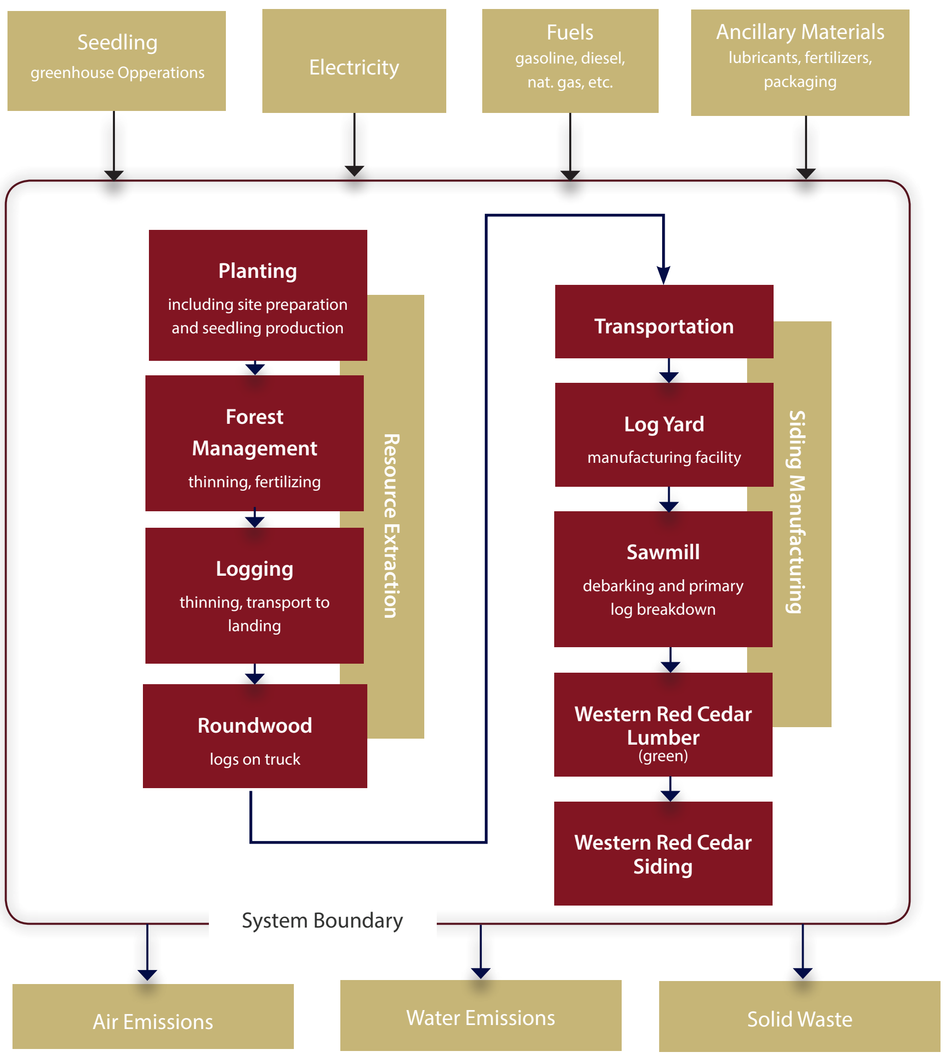
Life Cycle Assessment

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 for WRCLA in 2016 and was third-party peer-reviewed by James Salazar from Coldstream Consulting Ltd. The LCA study collected primary data from western red cedar lumber operations in 2015 for the production year 2014, which was combined with Athena Sustainable Materials Institute cedar resource extraction inventory data updated recently by FPInnovations.

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 and other materials such as packaging are included in the boundary unless below the cut-off criteria. 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 and capital equipment are excluded.

Figure 1. System boundary and process flows



Environmental Performance

The U.S. Environmental Protection Agency's TRACI (Tool for the Reduction and Assessment of Chemical and other environmental Impacts) v 2.1 life cycle impact assessment method is used to characterize the flows to and from the environment. Energy and material resource consumption, waste, and impacts per declared unit of cedar siding are shown in Table 1 and Table 2. Impact measures shown are global warming potential (GWP), acidification, eutrophication, smog, and ozone depletion.

Allocation of environmental burdens to cedar siding and its co-products is done according to economic allocation principles.

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

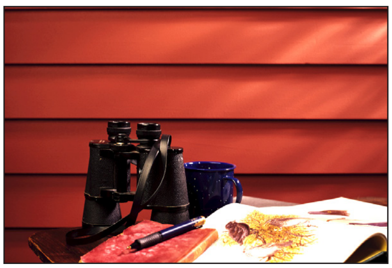
Indicator	Unit	Total	Resource extraction	Transport	Siding manufacturing
Energy consumption					
Total primary energy:	MJ eq.	3867.28	377.03	643.71	2846.54
Non-renewable, fossil	MJ eq.	2502.62	360.14	614.41	1528.08
Non-renewable, nuclear	MJ eq.	29.35	0.13	24.49	4.73
Renewable, biomass	MJ eq.	4.50	0.01	1.58	2.91
Renewable, (SWHG)	MJ eq.	1330.80	16.75	3.22	1310.83
Feedstock energy, renewable	MJ eq.	11,155.63			11,155.63
Environmental impacts					
Global warming potential (GWP)	kg CO_2 eq.	213.52	23.65	47.35	142.52
Acidification potential	kg SO_2 eq.	34.13	8.43	12.01	13.69
Eutrophication potential	kg N eq.	2.04	0.30	0.43	1.31
Smog potential	kg O_3 eq.	0.14	0.02	0.06	0.06
Ozone depletion potential	kg CFC-11 eq.	7.57E-06	3.69E-08	5.71E-06	1.82E-06
Material resources and fresh water consumption					
Renewable material consumption (wood)	kg	42.04	0.13	38.19	3.72
Non- renewable material consumption (clay and shale, coal, coarse aggregate, crude il, gypsum, iron ore, limestone, natural gas, sand, metal, uranium, etc.)	kg	1558.45	1542.45	0	16
Freshwater use	l	110.00	0.00	90.00	20.00
Waste					
Hazardous	kg	0.00	0.00	0.00	0.00
Non-hazardous (wood waste, wood ash and other solid waste)	kg	174.53	54.01	0.00	120.52

SWHG: Solar, wind, hydroelectric and geothermal

Table 2: Environmental performance of WRC siding on one square meter basis, by life cycle stage

Indicator	Unit	Total	Resource extraction	Transport	Siding
Energy consumption					
Total primary energy:	MJ eq.	45.32	4.42	7.54	33.36
Non-renewable, fossil	MJ eq.	29.33	4.22	7.20	17.91
Non-renewable, nuclear	MJ eq.	0.34	1.53E-03	0.29	0.06
Renewable, biomass	MJ eq.	0.05	1.23E-04	0.02	0.03
Renewable, (SWHG)	MJ eq.	15.60	0.20	0.04	15.36
Feedstock energy, renewable	MJ eq.	130.73			130.73
Environmental impacts					
Global warming potential (GWP)	kg CO_2 eq.	2.50	0.28	0.55	1.67
Acidification potential	kg SO_2 eq.	0.02	3.53E-03	0.01	0.02
Eutrophication potential	kg N eq.	1.62E-03	1.94E-04	7.19E-04	7.02E-04
Smog potential	kg O_3 eq.	0.40	0.10	0.14	0.16
Ozone depletion potential	kg CFC-11eq.	8.87E-08	4.33E-10	6.69E-08	2.13E-08
Material resources and fresh water consumption					
Renewable material consumption (wood)	kg	0.30	9.38E-04	0.28	0.03
Non- renewable material consumption (clay and shale, coal, coarse aggregate, crude oil, gypsum, iron ore, limestone, natural gas, sand, metal, uranium, etc.)	kg	11.27	11.16	0.00	0.12
Freshwater use	l	0.82	0.00	0.70	0.12
Waste					
Hazardous	kg	0.00	0.00	0.00	0.00
Non-hazardous (wood waste, wood ash and other solid waste)	kg	1.26	0.39	0.00	0.87

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



Glossary

Primary Energy Consumption

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

Global Warming Potential

This impact category refers to the potential change in the earth's climate due to accumulation of greenhouse gases and subsequent trapping of heat from reflected sunlight 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, these gas emissions are tracked and their potencies reported in terms of equivalent units of CO_2.

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 the main agents affecting these processes. Acidification potential is reported in terms of SO_2 mole equivalent per kilogram of emission.

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 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 atmosphere caused by emissions of zone-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 equivalent CFC-11.

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 square meter of siding basis, by life cycle

Impact category:	Unit	Total	Resource Extraction	Transport	Siding Manufacturing
Abiotic depletion	kg Sb eq.	1.88E-07	1.77E-09	1.11E-07	7.57E-08
Abiotic depletion (fossil fuels)*	kg Sb eq.	0.02	0.00	0.00	0.01
Global warming (GWP100a)	kg CO_2 eq.	2.49	0.28	0.55	1.66
Ozone layer depletion (ODP)	kg CFC-11 eq.	6.87E-08	3.62E-10	4.99E-08	1.85E-08
Human toxicity	kg 1,4-DB eq.	0.82	0.21	0.10	0.52
Fresh water aquatic ecotoxicity	kg 1,4-DB eq.	0.36	0.07	0.05	0.23
Marine aquatic ecotoxicity	kg 1,4-DB eq.	1849.64	275.81	192.27	1381.56
Terrestrial ecotoxicity	kg 1,4-DB eq.	3.25E-04	5.47E-06	1.63E-04	1.56E-04
Photochemical oxidation	kg C_2H_4 eq.	1.16E-03	9.69E-05	9.30E-05	9.72E-04
Acidification	kg SO_2 eq.	0.02	2.88E-03	4.06E-03	0.02
Eutrophication	kg PO_4 eq.	2.42E-03	5.23E-04	9.16E-04	9.78E-04
Total renewable energy	MJ	15.65	0.20	0.06	15.40
Total non-renewable energy	MJ	29.67	4.22	7.49	17.96
Total energy	MJ	45.32	4.42	7.54	33.36

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

Additional Environmental Information

Sustainable forestry

Western red cedar products 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. At the manufacturing gate, wood products are typically carbon-negative; that is, more carbon is stored in the product than was emitted during harvesting and manufacturing. See Tables 4 for the carbon balance at each life cycle stage, that is, the net carbon footprint per declared unit considering the carbon contained in the wood (a negative number) and the LCA carbon emissions (positive numbers). A negative number indicates a net climate change benefit (a greenhouse gas removal); a positive number is a net greenhouse gas emission. The final product, siding leaving the mill gate still caries negative carbon balance, meaning that siding has sequestered more carbon than cradle-to-gate carbon dioxide emissions. In other words, stored carbon in siding 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	-934.48	-10.95
GWP harvesting from forests	23.65	0.28
Net carbon balance cradle-to-round wood at forest	-910.83	-10.67
GWP transporting from forest to sawmill	47.35	0.55
Net carbon balance cradle-to-round wood at sawmill	-863.48	-10.12
GWP siding manufacture	142.52	1.67
Net carbon balance cradle-to-siding	-720.96	-8.45

GWP: Global warming potential

References

Bare, J. C., McKone, T., Norris, G. A., Pennington, D. W. 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 Wood Products v2. June 2015. Prepared by FPInnovations and available at www.fpinnovations.ca. PCR panel chaired by Thomas P. Gloria.

PCR Review was conducted by:

Thomas P. Gloria, Ph. D.
1 (617) 553-4929
www.industrial-ecology.com

Program Operator:
FPInnovations
Wood Products Division
Sustainabilty Group
2665 East Mall
Vancouver, BC, V6T 1W5 Canada
1 (604) 224-3221
www.fpinnovations.ca

EPD Owner:
Western Red Cedar Lumber Association
1501 – 700 West Pender Street
Vancouver, BC V6C 1G8
Canada
1 (866) 778-9096
www.wrcla.org

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

Independent verification of the declaration and data, according to ISO 14025 (please circle or check):

☐ internal ☒ external

Third Party Verifier:
Thomas P.Gloria, Ph.D.,
Industrial Ecology Consultants
35 Bracebridge Rd.
Newton, MA 02459-1728
1 (617) 553-4929
www.industrial-ecology.com

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.

Issued: June 2016
Valid until: June 2021