Cradle to Gate
Window Product Category Rule

September 10, 2015

v 1.02
Extended per PCRext 2021-110, valid through September 30, 2022

=

Earthsure PCR Cradle-to-Gate 30171600:2015

A Program of the Institute for Environmental Research and Education
PO Box 2449, Vashon WA 98070

earthsure

Table of Contents

Table of Contents 1

1 General Information 4

1.1 PCR Committee Members 4

1.2 Dates of Validity 4

1.3 LCA Standards Conformance 4

1.4 Identification of Window Product 4

1.5 Geographic Coverage 5

1.6 Language 5

1.7 Public Comment 5

1.8 PCR Review Panel 6

1.9 Public Commenters 6

1.10 Other Window Product Category Rules 6

1.11 LCA Study References 6

2 Goal and Scope 7

2.1 System Function 7

2.2 Declared Unit 7

2.3 Performance Standards 7

3 Inventory Analysis 8

3.1 System Boundary 9

3.2 Primary Data 9

3.3 Completeness & Cutoff Criteria 9

3.4 Packaging 9

3.5 Allocation 9

3.6 Recycled Waste Streams 10

3.6 General Waste Streams 10
3.7 Data Sources 10
3.8 Electric Grid 11
3.9 Units 11
3.10 Age of Data 11
3.11 Data Quality Assessment 11
3.12 Flow Chart 11
4 Newly Developed Unit Processes 12
4.1 Emissions Data Classification 12
4.2 Resource Data 12
4.3 Proprietary Information 12
4.4 Report and Review 12
5 Transportation Scenarios 12
6 Life Cycle Impact Assessment 13
7 Non-LCIA Information 14
7.1 Energy and material resources 14
7.2 Waste Production 14
7.3 Life Cycle Water Consumption 14
8 Sensitivity Analysis 14
9 Other Measures to be Disclosed 14
9.1 Mandatory Measures 14
9.2 Voluntary Measures 15
10 Format of the EPD 15
11 Definitions 16
12 Acronyms 17

13 Versions 18

14 Standards Referenced 18

Appendix A: Required Table of Results 19

Appendix B: List of Invited Interested Parties 20

Appendix C: Report of Review Team 21

References 22

Window Product Category Rule

1 General Information

1.1 PCR Committee Members

This PCR was developed by a large group of individuals over more than two years of discussion. During that time, several of the members have changed jobs. The members are shown below.

Jason Chesley, Pella Corporation
Kara Goscinski Cach, Guardian Industries
Jeff Haberer, Trulite Glass and Aluminum Solutions, formerly Cardinal Glass Industries
Kerry Haglund, Efficient Windows Collaborative
Jeffrey Inks, WDMA
Jim Krahn, Marvin Windows and Doors
Greg McKenna, Kawneer Co. Inc.
Annie Perkins, Andersen Windows
Helen Sanders, SAGE Electrochromics
Rita Schenck, IERE, Committee Chair
Mark Silverberg, Technoform NA, Inc.
Urmilla Jokhu-Sowell, GANA
Richard Walker, AAMA
Margaret Webb, IGMA

1.2 Dates of Validity

Publication: 10 September 2015

Expiry: 30 September 2022

1.3 LCA Standards Conformance

This PCR is developed in conformity with ISO 14040[i], 14044[ii], 14025[iii], 21930[iv] and IERE's Earthsure Program[v]. EPDs developed using this PCR will therefore be valid for the US Green Building Council's LEED v4 Program[vi]. The PCR Development was funded by the National Renewable Energy Laboratory. Outreach was by phone and email, with the list of individuals contacted shown in Appendix C**.**

1.4 Identification of Window Product

This rule covers exterior vertical window products provided by a single source supplier using industry wide components or windows based on North American data where available for use in buildings, including skylights, single opening windows, curtain walls, and storefronts. When the word "window" is

used in this document it denotes single window, curtain wall, skylights, and storefront windows, inclusively. It does not include any type of door, tubular daylighting devices or window component.

1.4.1 UNSPSC Codes

The following codes cover the range of this rule.

30171600	Windows
30171604	Double hung windows
30171605	Single hung windows
30171606	Casement windows
30171607	Horizontal slider windows
30171608	Tilt or transom windows
30171609	Fixed windows
30171610	Bay windows
30171611	Bow windows
30171612	Projected windows
30171613	Window walls
30171615	French windows
30171800	Skylights
30171801	Fixed Skylights
30171802	Vented Skylights

1.4.2 Construction Specification Institute Master Codes

08 43 00 Storefronts
08 44 00 Curtain Wall and Glazed Assemblies
08 44 33 Sloped Glazing Assemblies
08 50 00 Windows
08 51 00 Metal Windows
08 52 00 Wood Windows
08 53 00 Plastic Windows
08-54-00 Composite Windows
08 55 00 Pressure-Resistant Windows
08 56 00 Special Function Windows
08 60 00 Roof Windows and Skylights
08 61 00 Roof Windows
08 62 00 Unit Skylight

1.5 Geographic Coverage

This PCR is valid for North America

1.6 Language

This PCR was developed in English

1.7 Public Comment

In accordance with the Earthsure General Program Instructions, this PCR was published in two rounds of comments for at least one calendar month on the Earthsure website and all public comments from identifiable sources have been addressed, with responses posted on the website.

1.8 PCR Review Panel

The review panel included

Tom Gloria, LCACP Industrial Ecology Consultants, Chair

Adolf Merl, ThinkStep GmBH

Philip Moser, Simpson Gumpertz & Heger Inc.

1.9 Public Commenters

- Carrie Pearson & Stefanie Giese-Bogdan, 3M
- Dr. Albert Famuyibo
- John Erickson Cristiana Figueroa and Alex Stone, Washington State Department of Ecology
- Dennis Wilson, St. Gobain
- Jim Mellentine, Sustainable Solutions Corporation
- Julie Ruth, JRuth Code Consulting
- George A. Petzen, Linel - A Division of Mestek, Inc.
- Marijke Rymenants, Reynaers Aluminium
- Josh Coberley EFCO Corp.
- The Aluminum Association

1.10 Other Window Product Category Rules

Two other PCR's for window products were reviewed, both of them including doors and windows. The EPD-Norge PCR for Windows and Doors, April 2009, and the German IBU PCR for Windows and Doors, 16 July 2012.

The PCR committee consulted the documents during the development of this PCR. However, there were several aspects of these published PCRs that caused the PCR Committee to reject following these exclusively.

- The window industry wanted a PCR that was only for windows, not including doors**.**
- The data called out in these PCRs refers to European data sources, and not to North American relevant data sets.
- Some of the impact models called out refer to European models that are not applicable to North American environments**.**
- The PCRs require compliance to European laws, which are not applicable to the North American situation.
- The contained process flow charts were not detailed enough to be informative to North American manufacturers.

There is a PCR for window glass "GANA PCR for Flat Glass: UN CPC 3711" but it refers to only a portion of a window.

1.11 LCA Study References

In developing this PCR, the committee reviewed several LCA studies of windows, summarized by Salazar and Sowlati (2008)[vii].

2 Goal and Scope

The purpose and goal of this PCR is to provide a detailed method for developing a business-to-business (B-to-B) Environmental Product Declaration (EPD) to support comparable, informed, and objective sustainable purchasing of windows.

The scope of the PCR is Cradle to Gate with options. Use Phase energy calculations are omitted.

2.1 System Function

The function of a window is to connect the inside of the building to the outside providing daylight, and/or view and/or ventilation. While a window connects the indoor and outdoor spaces it also segregates the thermal, weather conditions, pressures, and acoustics of these spaces.

Windows provide other functions besides those noted here. Research shows that employees with windows to natural systems increase their productivity substantially due to comfort, physiological and psychological effects. Windows also can provide support for indoor environmental quality, emergency egress and ventilation. However, there are currently no consensus standards to measure these functions in the context of a life cycle functional unit, so they are not included in this product category rule.

2.2 Declared Unit

The functional Unit is one square meter (1 m^2) of window (including frame) meeting the performance standards noted below. The frame to glazing ratio of the Declared Unit shall be derived using the following NFRC standard sizes.

- Punched opening window: 1.2m x 1.5m
- Ribbon window: 1.5m x 1.3m
- Curtain wall: 1.5m x 1.6m
- Skylight: 1.2m x 1.2m

Many windows, especially in the residential market include screens. However they are not required for the primary function as defined by the Product Category Rule. Therefore they shall not be included as part of the Functional Unit.

2.3 Performance Standards

Product performance reported for this PCR shall be based upon testing and labeling to the requirements of the following Standards. For commercial site built products labeling is not required, but qualifying test reports are.

2.3.1 Residential Windows:

- AAMA/WDMA/CSA/101/IS2/A440) (NAFS-North American Fenestration Standard/Specification for windows, doors, and skylights) for the year of reference or newer
- NFRC 100; Procedure for Determining Fenestration Product U-Factors.
- NFRC 200; Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence (SHGC) & (VT).

2.3.2 Ribbon/Curtain Wall Windows:

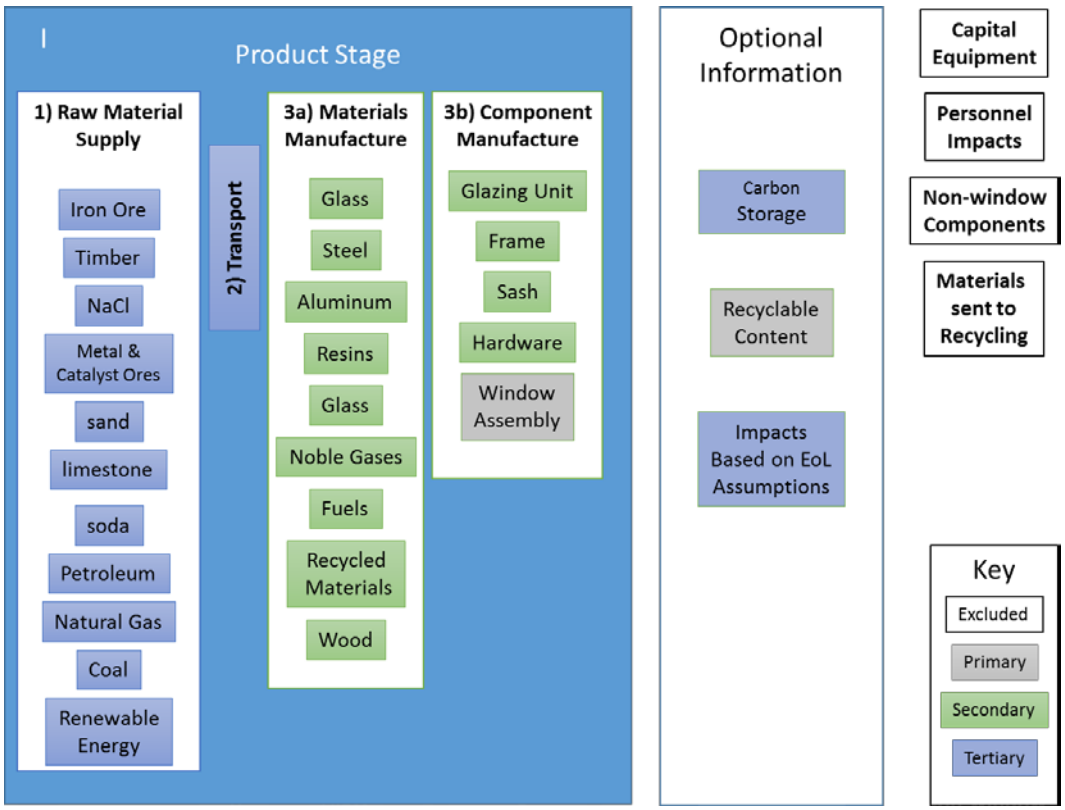
- AAMA/WDMA/CSA/101/IS2/A440) (NAFS-North American Fenestration Standard/Specification for windows, doors, and skylights) for the year of reference or newer or
- AAMA 501 Methods of Test
- NFRC 200; Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence (SHGC) & (VT).
  - NFRC 100; Procedure for Determining Fenestration Product U-Factors or
  - NFRC 705; Component Modeling Approach Product Certification Program or
  - AAMA 507 Standard Practice for Determining the Thermal Performance Characteristics of Fenestration Systems Installed in Commercial Buildings

3 Inventory Analysis

The life cycle inventory is the input and output data collected at the unit process level. The entire life cycle inventory of the product system is a combination of the unit process data. The data is used to calculate the Life Cycle Impact Assessment and ultimately the Environmental Product Declaration. All calculations shall be made using the standard sizes noted in Section 2.2.

The Life Cycle Inventory must be described with a flow chart substantially similar to the Figure 1 below.

Figure 1 Windows System Flow Chart



The figure must include the actual unit processes in the window life cycle (including as appropriate such items as gaskets, fasteners and coatings) and must make it clear which of the unit processes are derived from primary versus secondary data. Transportation shall conform to Transportation Scenarios section 5.

3.1 System Boundary

The system boundary of the LCI study excludes the production and disposal of capital equipment, but includes the operation of the equipment. The personnel impacts (travel to and from work; human emissions) are excluded. Where it is impossible to exclude office and personnel impacts (due to lack of sub-metering or measurement), these operations may be included, but a sensitivity analysis of this inclusion must be part of the study.

This life cycle inventory covers the cradle to gate with options. The stages of the life cycle from raw material extraction to the manufacturer's gate. Information on the potential impacts after demolition are included as optional elements.

3.2 Primary Data

Primary data shall be collected by the manufacturer of the windows. It shall include the location of the manufacture, the quantity and source location of all materials and energy used to manufacture the product, any emissions to air and water, any waste produced and how it is managed (e.g. recycled, landfill, incineration) and the distance traveled to disposal.

For any new unit processes developed, the requirements of the Earthsure GPI for naming conventions for flows, transformations, meta-data and modelling defaults shall be followed.

3.3 Completeness & Cutoff Criteria

At least 95% of all mass and energy used in the system shall be accounted for. No single flow that represents more than one percent (1%) of the total mass or energy flow shall be excluded. All toxic materials listed in the US EPA TRI (Toxic Release Inventory)[viii] shall be accounted for.

This is not an invitation to ignore portions of the life cycle. All known emissions to air, water and soil shall be included. At this time, there are no standards available for emissions from windows to indoor air.

3.4 Packaging

Primary and secondary packaging (e.g. pallets) are included in each life cycle phase. The treatment of the waste (recycling or disposal) shall be included in the life cycle phase in which it occurs.

3.5 Allocation

Where unit operations have more than one product, the impact of the operations, including waste disposal shall be allocated according to the mass of the product. This does not apply to energy producing processes, where energy shall be allocated according to the useful energy production (exergy). Where the mass of the product is not known, another unit such as economic allocation may be used, but it shall be converted to mass, and a sensitivity analysis performed on the potential range of the conversion. In the case of energy producing operations, the impacts are allocated according to energy production, on a useful energy equivalent basis.

As this is an EPD, strict sustainability accounting is employed. No system boundary expansion or consequential analysis is permitted, and no credits for displacement are permitted.

3.6 Recycled Waste Streams

Recycling and recycled content shall be modeled using the cutoff rule (also known as the recycled content rule). All materials that are recycled from unit processes (including those sent to energy recovery) are considered to have left the system boundary. Recycled content can only be modeled in the system where there is primary data showing that the percent of recycled content was specified in the purchase of materials. Where the product system has specified recycled content, all the environmental burdens of recycling shall be included in the raw material portion of the inventory. The impact of recycling shall be calculated from the point of discard, either at the discarding facility or at the waste management center. Captive recycling is within the system boundary.

Where the manufacturer has an active recycling program in place for the replacement or demolition of the product, that information may be used for the product, but only to the extent which the manufacturer's program actually recycles windows. For example, if the manufacturer produces 100,000 windows per year, and recycles 10,000 windows per year, then the 10,000 windows are removed from the life cycle waste calculations, and the 90,000 windows are modeled in accordance to the average disposition of demolition waste for that location (e.g. landfill or incinerator).

3.6 General Waste Streams

Where waste disposal methods are known, they shall be modeled for waste disposal. Where they are not known, the most recent waste inventory data from the U.S. EPA Office of Solid Waste or equivalent for the host country shall be used.

3.7 Data Sources

When developing the LCIA for the purpose of publishing an EPD, Companies shall seek primary data from first tier suppliers representing at least 80% of the mass of their technosphere inflows. Only when primary data is not available may secondary or tertiary data sources be used. Where tertiary data is used, the most relevant data shall be used, in the following order of preference, from most to least desired: same locality>regional>national> global> other locality. Where properly reviewed U.S. LCI database sets or EU ELCD or other national or regional datasets are available, they shall be used for national data. Care should be taken too assure that equivalent system boundaries are used for the unit processes.

The LCIA shall disclose the percent of the technosphere flows that are primary data. When secondary or tertiary data are used, they shall be documented as to the name of the database and the age of the data. If consensus data is used for primary materials, it shall be documented. Any deviation from the use of North American data by practitioner shall be documented.

All data sources shall be specified, including database and year of publication (reference). Sources of data for transport models and thermal energy production shall be documented. Any changes or alterations to information from the LCI libraries in the LCA software shall be documented with the reasons for making the alteration. For example, if the EU electric grid information on a substance from

the EU ELCD was replaced by the average US electric grid information to make it relevant, then this action shall be documented.

All foreground technosphere data shall be primary data, collected over the most recent calendar year of operation or measurement year where the start date is not more than two years prior. The measurement dates shall be disclosed in the LCA study. If primary data for more than one location is averaged for a unit process, a sensitivity analysis shall be performed using a plus or minus one standard deviation of the technosphere flow.

3.8 Electric Grid

The electric grid for foreground operations should represent the local electric grid mix (as supplied by the local electric utility). Where unit operations are background data, or where the local utility will not provide the data, the unit operations shall represent the most appropriate regional or national electric grid data as published by the U.S. LCI Database[ix], the EU Database (ELCD)[x], or other relevant national, public, or regional databases. If the manufacturer has multiple locations, then the grid make-up of each location shall be averaged based on production volume**.**

3.8.1 Renewable Energy

Where the unit process is powered by methane from solid waste or wastewater, wind, biomass, hydro or solar power and no energy leaves the facility (i.e. the system is not linked to a grid), renewable electricity produced from wind or solar may be accounted for within the system boundary.

3.8.2 Carbon Offset Credits

No carbon offset credits may be included in the calculation. Carbon offset credits are not the same as carbon sequestration. Carbon offset credits are a form of trade, and are purchased to fund projects that reduce greenhouse gas emissions.

3.9 Units

All LCIA data must be in SI (metric) units. Optionally, IP (English) units may be added in parentheses.

3.10 Age of Data

The life cycle inventory must include information about the age of the data. All foreground data must be no more than three years old, unless it is affirmed by a competent authority that the processes they described have not substantively changed. A competent authority has a higher degree in the relevant industry or has worked for at least five years in the industry. No data or dataset more than 10 years old shall be used, unless it is affirmed by a competent authority that the processes they described have not substantively changed.

3.11 Data Quality Assessment

A data quality assessment reviewing each of the above data quality parameters shall be performed for all primary data collected, and for all secondary data used. It shall be reported in tabular format in the LCA study.

3.12 Flow Chart

A flow chart showing the system boundaries shall be included in the LCA study, substantially similar to Figure 1 above.

4 Newly Developed Unit Processes

The unit process based Life Cycle Inventory shall describe each of the unit processes as described above and as called out in ISO 14040 and 14044. All newly developed unit process based Life cycle inventory shall describe each of the unit processes as described above and below and as called out in ISO 14040 and 14044.

4.1 Emissions Data Classification

All emissions factors used must be identified as primary (developed for the local unit process, or based on biological, chemical or physical constants such as stoichiometric equivalents), secondary (derived from studies of equivalent processes) or tertiary (derived from the aggregation of multiple similar processes).

4.2 Resource Data

All Resources LCI data must be expressed as in-ground, in air or in water amounts.

4.3 Proprietary Information

Nothing in this Product Category Rule obligates the manufacturer to disclose proprietary or confidential information.

4.4 Report and Review

The LCA study must be produced as a third-party report according to ISO 14044:2006. The project LCA documentation must be made available to the reviewer and must conform to ISO 21930 Section 7.3, including the entire inventory, such disclosure under non-disclosure agreement. The reviewer shall perform reviews per ISO 14044, 21930 and the Earthsure General Program Instructions.

5 Transportation Scenarios

Where primary data is available, the transportation model shall be based on information on fuel consumption and mode of transport. Where only distance is known and the transport is via common carrier (i.e. secondary data), the following assumptions shall be made

In the absence of primary data the following criteria shall be used:

- All rail is assumed to have no empty haul-back. It is diesel powered.
- Road transport is via diesel powered 20-ton tractor-trailers, with empty haul-back 50% of the time. This is equivalent to a 75% utilization of the vehicle, unless the material is transported in bulk trucks, which are assumed to return empty.
- Ocean transport has no empty haul-back. It is diesel powered using bunker oil.
- Air transport has no empty haul-back.

Where neither distance nor mode are known the default transport values listed in Table 1 and Table 2 below shall be used.

Table 1 Default Transport Values by Life Cycle Stage

Life Cycle Stage	DEFAULT DISTANCE, km Using 20-ton, diesel trailer
Raw Materials (Mixed Freight)	600
Manufactured Products	1600
Waste and Scrap	200

Table 2 Default Transport Values by Mode

Mode	DEFAULT DISTANCE, km
Ship	700
Airplane (jet cargo)	1800
Rail	1500

6 Life Cycle Impact Assessment

Life cycle impact assessment results do not predict impacts on category endpoints, exceeding thresholds, safety margins or risks. They do provide estimates of potential impacts. The impact assessment models shall be to the greatest extent possible those shown in the US EPA TRACI method, Version 2.1[xi], and include on those list in Table 3, below. The impact categories include Climate Change, Acidification, Eutrophication, Ozone Depletion, and Photochemical Smog

Specifically excluded in this analysis are measurement of toxicity, land use and soil depletion. The committee felt that the models for these impacts are poorly developed and are not useful for describing impacts of windows manufacturing.

Table 3 Impact Categories and Models

Impact Category	Category Indicator	Model Source (TRACI 2.1)
Global Climate Change	Mass of CO_2 Equivalents	Intergovernmental Panel on Climate Change, Most recent publication[xii]
Acidification	Mass SO_2 Equivalents	Stoichiometric equivalents
Eutrophication	Mass Nitrogen equivalents	Redfield Ratioxiii
Ozone Depletion	Mass of CFC-11 Equivalents	Montreal Protocol (as in TRACI)[xiv]
Photochemical Smog Formation	Mass O3 equivalents	TRACI

7 Non-LCIA Information

In addition to the LCIA results shown above, the EPD shall also disclose these additional life cycle inventory results.

7.1 Energy and material resources

The amount of primary energy (renewable and non-renewable) shall be disclosed, based on the higher heating value and expressed as MJ per declared units. The amount of renewable and non-renewable materials used shall be disclosed in units of kg per declared unit.

7.2 Waste Production

The mass of hazardous and non-hazardous wastes produced shall be disclosed in units of kg per declared unit.

7.3 Life Cycle Water Consumption

Consumptive fresh water use shall be disclosed. This use includes all uses of water that remove the water from use within the same watershed. For example, water used for irrigation or evaporative cooling shall be included, but water used to create hydropower or for once-through cooling water shall not be included. No distinction between groundwater and surface water shall be made.

8 Sensitivity Analysis

Sensitivity analyses shall be performed when

- Allocation is used but it is not related to mass or energy flows
- Personnel impacts are included in the measurement
- Data gaps are filled using proxy data
- Primary data from more than one location is averaged for a unit process.

The EPD shall explain the results of the sensitivity analyses, describing their implication on the certainty of the EPD results.

9 Other Measures to be Disclosed

9.1 Mandatory Measures

9.1.1 Disclosure of Window Hazardous Content

Any material hazardous to human health and the environment present in at least 0.1% of the window (not including the packaging) shall be disclosed. At a minimum, substances on the Candidate List Substances of Very High Concern[xv] shall be disclosed.

9.2 Voluntary Measures

9.2.1 Third-Party Certifications

Third-party certifications may be disclosed in the EPD. The certification must be documented through the certifying body, and a hyperlink provided to the certification.

9.2.2 Carbon Storage

The amount of carbon in bio-based (e.g. wood) components of the window itself, expressed as CO_2 equivalents may be disclosed in the EPD. Carbon storage of wood in the window shall be calculated by converting the mass of the wood into CO_2 equivalents using the following equation, which is based on assuming that kiln dried wood is composed of 50% carbon and has a default moisture content of 12%. If the exact moisture content of the wood used in the product is known, that may be documented and used in the calculation to replace the default value of 0.88.

0.88 kg dry wood/1 kg wood * 0.50 kg C/kg dry wood * 3.67kg CO_2-eq/kg C = 1.61 kg CO_2-eq/kg wood

Mass wood x 1.61 = Mass CO_2 equivalents

9.2.3 Recyclable content

The recyclable content of the window itself (does not include the packaging) may be disclosed. Recyclable content refers to materials that can be recycled in at least 60 percent of the markets in which the windows are sold.

9.2.4 Calculation of Impacts Based on End of Life Alternative Assumption

In addition to reporting primary EPD results using the cutoff allocation method, the EPD may optionally report end of life results based on calculations using different recycling allocation methods, such as the avoided burden/end-of-life recycling. If such calculations are included, they must not be factored into, combined or reported in the primary EPD calculations and shall be reported separately. When reported separately, this information shall be clearly labeled as different from the primary EPD information (which uses a cutoff allocation methodology) and must identify what assumptions were made in the calculations.

10 Format of the EPD

The Business-to -Business Format of the EPD shall consist of a third-party LCA report as described in ISO 14044:2006 and shall in addition include:

- The name of the product, with any numerical identifier
- A description of the use of the product
- Any specifications or consensus standards the product meets
- A photograph of the product
- A table substantially similar to that shown in Appendix A.
- The name and logo of the producer of the product

- The name of this PCR
- The name and logo of Earthsure as the Program Operator
- The date of expiry of the EPD
- The table of the impact indicator results, shown by life cycle stage
- Validation by third party LCACP that the EPD conforms with this PCR, with the format as below.

  Independent verification of the declaration and data, according to ISO 14025 (please indicate)
  Internal _____ External_____

  If required, third party verifier:
- Contact information for the validator.

An independent reviewer may be internal or external. Independence means that the reviewer did not participate in the gathering or analysis of the data or the preparation of the LCA report or the EPD itself

Please Note:

- The EPD shall include a disclaimer stating the EPD and PCR process is informational only and does not warranty performance.

11 Definitions

Background data: Data from processes not under operational control of the EPD owner.

CAS Number: Numeric identifier of chemicals provided by the Chemical Abstracts Service.

Consumptive water use is water removed from available supplies without return to a water resource system (e.g., water used in manufacturing, agriculture, and food preparation that is not returned to a stream, river, or water treatment plant).

Curtain Wall: Per AAMA/WDMA/CSA 101/I.S.2/A440-05, “an external non-bearing wall, intended to separate the exterior and interior environments.”

Cutoff criteria: Specification of the amount of material or energy flow or the level of environmental significance associated with unit processes of a product system to be excluded from a LCA study (adapted from ISO 14044).

Ecosphere flows: Raw materials taken from nature or returned to nature.

EPD owner: The organization developing the EPD, usually the manufacturer.

First tier suppliers: Company selling product to the company seeking the EPD.

Foreground data: Data from processes under operational control of the EPD owner.

Glazing (n): An infill material such as glass or plastic.[xvi]

Glazing (v): The process of installing an infill material into a prepared opening in windows, and other products.[xvii]

Primary data: Raw data is data by company individuals that are directly related to that company, e.g., electricity invoices, monthly monitoring data, supplier sources, etc.

Secondary data: Aggregated or modified data from a reputable source, e.g. descriptions of the local electric grid derived by the local utility company, published peer review articles, etc.

Technosphere flows: These are identical to intermediate flows as defined in ISO 14044. Examples are the use of materials and electricity and the production of goods and services.

Tertiary data: Data aggregated from many sources, e.g. in commercial databases.

Type III environmental declaration/label (EPD): Environmental declaration that provides quantified environmental data of a product, using predetermined parameters and, where relevant, additional environmental information (adapted from ISO 14025).

Unit process: The lowest level at which life cycle inventory data is available.

Window: An operable or non-operable product that is part of a building enclosure that admits sunlight and sometimes ventilation, and is usually framed and glazed. A storefront is a specific reference to a window found in the front portion of a commercial business and is usually installed between floor and ceiling. A curtain wall is a specific type of window usually found in commercial buildings of more than one story and spans past floor slabs, and is a non-structural exterior wall. A skylight is a specific type of window installed at a slope of 60-degrees from horizontal or less.

12 Acronyms

BOD: Biological Oxygen Demand
B-to-B: Business to business oriented EPD
B-to-C: Business to consumer oriented EPD
COD: Chemical Oxygen Demand
IECC: International Energy Conservation Code
ELCD: European Life Cycle Database
EPD: Environmental Product Declaration
EU: European Union
ILCD: International Reference Life Cycle Data System
IPCC: Intergovernmental Panel on Climate Change
IRC: International Residential Code
LCA: Life Cycle Assessment
LCACP: Life Cycle Assessment Certified Professional, through the American Center for Life Cycle Assessment, the Australian LCA Society or the LCA Society of New Zealand
LCI: Life Cycle Inventory
LCIA: Life Cycle Impact Assessment
MJ: Megajoule
NAFS: North American Fenestration Standard
NREL: National Renewable Energy Laboratory
PCR: Product Category Rule
PM: Particulate matter
TRACI: Tool for the Reduction and Assessment of Chemical and other Impacts

TSS: Total suspended solids (water)
VOCs: Volatile Organic Compounds

13 Versions

Version 1.01: 10 November 2015 made editorial corrections

14 Standards Referenced

The following standards are incorporated by reference:

ANSI/ASHRAE/IES Standard 90.1-2013 -- Energy Standard for Buildings Except Low-Rise Residential Buildings
IECC 2012 International Energy Conservation Code (First Printing)
ISO 14025:2006, Environmental labels and declarations – Type III environmental declarations – Principles and procedures
ISO 14040:2006 Environmental management – Life cycle assessment – Principles and framework
ISO 14044:2006 Environmental management – Life cycle assessment – Requirements and guidelines
ISO 18292:2011 Energy performance of fenestration systems for residential buildings -- Calculation procedure
AAMA 501 Methods of Test
AAMA 507 Standard Practice for Determining the Thermal Performance Characteristics of Fenestration Systems Installed in Commercial Buildings
AAMA/WDMA/CSA/101/IS2/A440 North American Standard Specification (NAFS)
NFRC 100; Procedure for Determining Fenestration Product U-Factors.
NFRC 200; Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible
NFRC 705; Component Modeling Approach Product Certification Program
Transmittance at Normal Incidence (SHGC) & (VT)
IRC 2012, International Residential Code for One and Two-Family Dwellings,
International Residential Code for One- and Two-Family Dwellings 2012 (Second Printing)

Appendix A: Required Table of Results

This table shall be included as the primary report of the cradle to gate environmental impacts

Company LOGO

[ABC Window Company] provides this ecolabel in accordance with the ISO 14025 and 21930 standards. It is valid for [xyz models] from [date] until [date]. Summary of Environmental Impacts, Cradle to Gate for 1m² of [Name of Product, part numbers of products]

Life Cycle Impact Assessment Results		
CATEGORY INDICATOR	**Units per 1m²**	**Manufacturing Impact (cradle to gate)**
Global Climate Change	Mass of CO2 Equivalents	
Acidification	Mass SO2 Equivalents	
Eutrophication	Mass Nitrogen equivalents	
Ozone Depletion	Mass of CFC-11 Equivalents	
Photochemical Smog Formation	Mass O3 equivalents	
Use of resources and renewable primary energy		
Depletion of non-renewable energy resources	MJ (HHV)	
Depletion of non-renewable material resources	MJ (HHV)	
Use of renewable material resources	MJ (HHV)	
Use of renewable primary energy	MJ (HHV)	
Consumption of freshwater	L	
Waste Production		
Non-hazardous waste generated	Kg	
Hazardous waste generated	Kg	

[Voluntary Disclosures, e.g. "This window stores XX grams of CO_2 equivalents and has XX percent recyclable content."] This analysis was performed in conformity with the Earthsure program of the Institute for Environmental Research and Education using Cradle to Gate PCR 30171600-2015. Ecolabels prepared under other programs may not be comparable. This EPD is informational and does not warrant performance. It was validated by [name of reviewer]. For more information contact earthsure@iere.org or [ABC contact].

Appendix B: List of Invited Interested Parties

James C. Benney	The National Fenestration Rating Council (NFRC)
Paul Bertram	Kingspan
Eden Bruckman	International Living Futures Institute
John Carmody	Center for Sustainable Building Research, U.Minn
Alberta Carpenter	NREL
Jason Chesley	Pella Corporation
Scott Condreay	SAPA
David Cooper	Guardian Industries
Tom Culp	Birch Point Consulting LLC
Michael Deru	NREL
Liz Dunn	Green Building Lab, National Trust for Historic landmarks
Steve Farrar	Guardian Industries
Steve Fronek	Wausau/Apogee
Heather Gadonnieux	UL Environment
Ray Garries	JELD-WEN
Jeff Haberer	Trulite Glass & Aluminum Solutions, formerly with Cardinal Glass
Jon Hughes	AGC Glass
Don Horn	GSA
Jeff Inks	WDMA
Steve Johnson	Andersen Corporation
Urmilla Jokhu-Sowel	GANA
Mike Koenig	Andersen Corporation
Paul LaBerge,	LaBerge Daylight, formerly with Apogee Inc.
Anne Landfield-Greig	Four Elements Consulting
Angie Leith	US EPA HQ
Mike Levy	American Chemistry Council
Bobbie Lippiatt	NIST
George T. Middleton	Consultant to the vinyl industry
Ann Ngo	ITA, US Dept. of Commerce
Helen Sanders	SAGE Electrochromics
Kevin Seiling	Veka, Inc.
Mark Silverberg	TechnoForm
Kathrina Simonen	University of Washington
Mike Turnbull	Guardian Industries
Rich Walker	American Architectural Manufacturers Association (AAMA)
Ben Wallace	Marvin Windows and Doors
Margaret Webb	Insulating Glass Manufacturers Alliance
Kerry Haglund	University of Minnesota
Melissa Winters	US EPA Region X
Nana Wilberforce	PNC
Alison Kinn-Bennett	US EPA HQ
Paul Vanderwal	Milgard

Appendix C: Report of Review Team

Industrial Ecology Consultants
35 Bracebridge Road

Newton, Massachusetts 02459

Critical Review by Independent Third Party

The program operator, Earthsure commissioned a panel of qualified experts to review the Cradle to Gate Window Product Category Rule (Earthsure PCR Cradle to Gate - 30171600:2015). The objectives of the review were to verify conformance to the applicable International Organization of Standardization (ISO) standards and Earthsure General Program Instructions (GPIs). As such, Industrial Ecology Consultants assembled an expert panel that included an LCA practitioner and two industry experts to assist with the conformance review. Specifically, the panel of reviewers of the study included:

Dr. Thomas P. Gloria, Ph.D. (Chair)
Managing Director,
Industrial Ecology Consultants

Adolf D. Merl, Dipl. –Ing. Dr. Techn.
Managing Director,
thinkstep, GmbH, Austria.

Philip S. Moser, P.E. (MA), LEED AP
Senior Staff II – Building Technology
Simpson Gumpertz & Heger

Review Results
On the basis of the objectives set forth to review this PCR, the review panel concludes that the PCR conforms to the applicable ISO standards: ISO 14025, ISO 14040, ISO 14044, and ISO 21930; and the General Program Instructions of Earthsure.

Respectfully,

Thomas P. Gloria, Ph.D.

4 May 2015
Newton, Massachusetts, US

References

[i] ISO 14040: Environmental management — Life cycle assessment — Principles and framework

[ii] ISO 14044. Environmental management — Life cycle assessment — Requirements and guidelines

[iii] ISO 14025: Environmental labels and declarations —Type III environmental declarations —Principles and procedures

[iv] ISO 21930-2007 Sustainability in building construction — Environmental declaration of building products.

[v] Earth sure® Environmental Product Declarations General Program http://iere.org/Data/Sites/1/SharedFiles/earthsure/Earthsure%20General%20Program.pdf

[vi] (USGBC, 2014)

[vii] James Salazar & Taraneh Sowlati A review of life-cycle assessment of windows.(Practicalities and Possibilities) By | Forest Products Journal - Oct, 2008

[viii] U.S. Environmental Protection Agency (EPA), Washington, DC. Toxics Release Inventory Program." Accessed 2009-12-20.

[ix] National Renewable Energy Lab. US Life Cycle Inventory Database. http://www.nrel.gov/lci/

[x] Joint Research Centre, European Commission. European Life Cycle Database http://lca.jrc.ec.europa.eu/lcainfohub/datasetArea.vm

[xi] UNITED STATES ENVIRONMENTAL PROTECTION AGENCY ORD/NRMRL/Sustainable Technology Division Systems Analysis Branch STD Standard Operating Procedure (SOP) SOP No. S-10637-OP-1-0 (2012)Tool for the Reduction and Assessment of Chemical and other Environmental Impacts (TRACI) Software Name and Version Number: TRACI version 2.1 USER'S MANUAL

[xii] Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Avery, M. Tignor and H.L. Miller (eds Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, 2007) Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA

[xiii] Redfield, A.C. 1934. On the proportions of organic derivatives in seawater and their relation to the composition of plankton. In Daniel, R.J [Ed] *James Johnstone Memorial Volume.* University Press of Liverpool pp.177-192

[xiv] United Nations Montreal Protocol. http://ozone.unep.org/new_site/en/montreal_protocol.php

[xv] (European Ccmmission 2015) Candidate List of substance of very high concern http://echa.europa.eu/candidate-list-table

[xvi] AAMA/WDMA/CS 101/I.S.2/A440-11

[xvii] AAMA/WDMA/CS 101/I.S.2/A440-11