LAFARGE RICHMOND PLANT
ENVIRONMENTAL PRODUCT DECLARATION

A MEMBER OF HOLCIM

About this EPD

This is a cradle-to-gate environmental product declaration for OneCem® General Use Limestone (GUL, Type IL) Cement produced at Lafarge's Richmond, BC plant. The life cycle assessment was prepared according to ISO 14025:2006, ISO 21930:2017 (the core PCR) and the NSF Portland, Blended, Masonry, Mortar, and Plastic (Stucco) Cements product category rule (subcategory PCR). This environmental product declaration (EPD) is intended for business-to-business audiences.

Product Group and Name	Portland Cement, UN CPC 3744, UNSPSC Code 30111601
EPD Commissioner and Owner	Lafarge Canada Inc. #300 115 Quarry Park Road SE Calgary AB, T2C 5G9 www.lafarge.ca Lafarge, a member of Holcim, provided LCI and meta-data for clinker production and grinding for the reference year 2022. The owner of the declaration is liable for the underlying information and evidence.
Manufacturer Name and Address	Lafarge Canada Inc. Lafarge Richmond Plant 7611 No 9 Rd Richmond BC V6W 1H4
Program Operator	ASTM International
General Program Instructions and Version Number	ASTM General Program Instructions, v8.0, April 29, 2020.
Declaration Number	EPD 606 – Lafarge Richmond Cement Plant
Reference PCR and Version Number	ISO 21930:2017 Sustainability in Building Construction – Environmental Declarations of Building Products serves as the core PCR. Product Category Rule for Environmental Product Declarations: PCR for Portland, Blended, Masonry, Mortar, and Plastic (Stucco) Cements v3.2, September 2021 serves as the sub-category PCR.
EPD Type and Scope	Cradle-to-gate (modules A1 to A3). Facility and product-specific.
Declared Unit	1 metric tonne of OneCem® (GUL, Type IL) cement
Product Intended Application and Use	**OneCem®** (GUL, Type IL) cement is a portland cement in which finely ground limestone (5 to 15%) is an integral component within the cement. OneCem® has been designed to perform similarly to existing cements and is rigorously tested to verify its performance. OneCem® is currently manufactured according to CSA A3001-18 and ASTM C595 for use in concrete.
Product Reference Service Life	Not Applicable (B modules not included in scope)
Markets of Applicability	United States and Canada
Date of Issue	December, 2023
Period of Validity	5 years (December, 2028)

Year of Reported Manufacturer Primary Data	2022 Calendar Year
LCA Software and Version Number	GCCA Industry EPD tool for Clinker, Cement, Aggregates, Concrete, and Precast products, North America version 4.1
LCI Database and Version Number	GCCA inventory v4.1 and ecoinvent v3.5
LCIA Methodology and Version Number	TRACI 2.1
Overall Data Quality Assessment Score	High
Sub-category PCR review	The sub-category PCR review was conducted by: Dr. Thomas P. Gloria, PhD (Chair), Industrial Ecology Consultants t.gloria@industrial-ecology.com Mr. Bill Stough, Sustainable Research Group Mr. Jack Geibig, EcoForm
EPD Verification	This declaration was independently verified in accordance with ISO 14025:2006. ISO 21930:2017 serves as the core PCR. Sub-category PCR: PCR for Portland, Blended, Masonry, Mortar, and Plastic (Stucco) Cements v3.2, September 2021 ☐ Internal ☑ External This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by: Tim Brooke ASTM International 100 Barr Harbour Drive PO Box C700 West Conshohocken PA 19428-2959 USA cert@astm.org
LCA Report and EPD Preparation	This life cycle assessment was conducted in accordance with ISO 14044 and the reference PCR by: Matt Dalkie Lafarge Canada Inc. 2300 Rogers Avenue Coquitlam BC V3K 5X6 Canada
Explanatory Material	For any explanatory material, regarding this EPD, please contact Matt Dalkie (matt.dalkie@lafarge.com).

Lafarge & Production Facility

Lafarge is a member of Holcim, the global leader in building materials and solutions. As the largest provider of diversified construction materials in Canada, Lafarge's ambition is to lead the industry in reducing carbon emissions and shifting towards low-carbon construction.

In Canada, Holcim has 400 subsidiary companies across Canada and the US Pacific North West, employing 6,000 people. Our customers rely on us to help them design and build better communities with innovative solutions that deliver structural integrity and eco-efficiency.

Facility Name	Lafarge Richmond Plant 7611 No 9 Rd Richmond BC V6W 1H4

In 1956, Paris-based Lafarge expanded its worldwide operations to North America by opening the Richmond Cement Plant in British Columbia with production starting on February 17, 1958. Since that time, Lafarge continued to expanded its role in cement as well as developed operations in aggregates, concrete, and asphalt. The Richmond Cement Plant underwent a major capital investment and upgraded the facility to a modern, state of the art pre-calciner kiln line technology bringing capacity to over one million tonnes. The modern kiln line began operation in May 1999 and remains in operation today.

Product Description

This EPD reports environmental transparency information for OneCem® produced at Lafarge's Richmond, BC plant. OneCem® cement is a portland cement in which finely ground limestone (5 to 15%) is an integral component within the cement. OneCem® has been designed to perform similarly to existing cements and is rigorously tested to verify its performance. OneCem® is currently manufactured according to CSA A3001-18 and ASTM C595 for use in concrete.

Products and Standards

The Table below sets out the OneCem® constituents and applicable standards. All Richmond products are sold in bulk.

Material Inputs	**% of Total Inputs**
Clinker	81%
Gypsum, Limestone	19%
Total	**100%**

Applicable Standards:
ASTM C595 / C595M – 23 Standard Specification for Blended Hydraulic Cement
ASTM C1157 / C1157M – 23 Standard Performance Specification for Hydraulic Cement
AASHTO M240M/M240 – 23 Standard Specification for Blended Hydraulic Cement
CSA A3000 – 18 Cementitious Materials Compendium

Note:
CSA cement type designations have been used throughout this document as the primary identifier. The equivalent types and classes for CSA Type GUL cement under other standards are ASTM Type IL (ASTM C595/C595M and AASHTO M240) and ASTM Type GU (ASTM C1157/C1157M). Cements are produced to meet all applicable standards shown.

Declared Unit

The declared unit is one metric tonne of OneCem®.

System Boundary

This cradle-to-gate EPD covers the production stage (LCA modules A1-A3) as depicted in the figure below. The production stage includes procurement of raw materials (cradle) through the manufacture of GUL cement ready for shipment (gate).

Production			Construction		Use							End-of-Life				
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Extraction and upstream processing	Transport to factory	Manufacturing	Transport to site	Installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction or demolition	Transport	Waste Processing	Disposal of waste	Optional information beyond system boundary

Included in LCA scope
Excluded from LCA scope

Items *excluded* from the system boundary include:

- Production, manufacture, and construction of manufacturing capital goods and infrastructure
- Production and manufacture of production equipment, delivery vehicles, and laboratory equipment
- Personnel-related activities (travel, furniture, and office supplies)
- Energy and water use related to company management and sales activities that may be located either within the factory site or at another location

Cut-off Criteria

The cut-off criteria as per NSF PCR, Section 7.1.8 and ISO 21930, 7.1.8 were followed. Per ISO 21930, 7.1.8, all input/output data required was collected and included in the LCI modelling. No substances with hazardous and toxic properties that pose a concern for human health and/or the environment were identified in the framework of this EPD. Any plant specific data gaps for the reference year 2022 e.g. amount of lubricants were filled in with industry data (secondary data).

Primary Data Collection

Gate-to-gate input/output flow data was collected for the following processes for the reference year 2022:

- Clinker production and cement manufacture – Richmond, BC.

Richmond's direct greenhouse gas (GHG) emissions were calculated in accordance with Canada's Greenhouse Gas Reporting Program (GHGRP) as reported to the Province of British Columbia and Government of Canada. Calcination emissions were calculated based on the Cement CO2 and Energy Protocol detailed output method (B2) published by the Global Cement and Concrete Association (GCCA). Direct GHG emission data were audited by PwC Canada to verify compliance with provincial and federal reporting requirements.

Allocation Rules

Allocation follows the requirements and guidance of ISO 14044 Clause 4.3.4, NSF PCR, and ISO 21930 section 7.2. Recycling and recycled content are modeled using the cut-off rule. The sub-category PCR recognizes fly ash, furnace bottom ash, bypass dust, mill scale, polluted soils, spent catalyst, aluminum oxide waste, silica fume, granulated blast-furnace slag, iron-rich waste, cement kiln dust (CKD), flue gas desulfurization (FGD) gypsum, and calcium fluoride-rich waste as recovered materials and thus the environmental impacts allocated to these materials are limited to the treatment and transportation required to use as a cement material input. Further, used tires, plastics, solvents, used oils and oily waste, coal/carbon waste, roofing asphalt, household refuse-derived waste and non-hazardous liquid waste are considered non-renewable and/or renewable secondary fuels. Only the materials, water, energy, emissions, and other elemental flows associated with reprocessing, handling, sorting and transportation from the point of the generating industrial process to their use in the production process are considered. All emissions from combustion at the point of use are considered.

Data Sources, Quality Requirements, and Assessment

It should be noted that the data quality assessment here covers only the clinker and cement production inventories (i.e., activity data). An evaluation of the quality of data used to model background processes (e.g., electricity generation) has also been carried out, and the results are located in the *LCA core model and database report* of the *North American version of GCCA tool for EPDs of concrete and cement.*

Data Quality Requirements	Description
Technology Coverage	Data represents the prevailing technology in use at the Richmond, BC facility. The Richmond, BC facility utilizes a pre-calciner kiln technology and rotary ball mills. *Technological representativeness is characterized as "high".*
Geographic Coverage	The geographic region for manufacturing is considered BC. The electricity is modeled based on BC Hydro 2022/23 Annual Service Plan Report with imported electricity modeled as eGRID 2021 NWPP, consisting of 76.2% hydro, 8.4% gas, 8% coal and peat (including 0.4% unspecified other), 4.6% wind, 1.2% nuclear, 0.9% solar, 0.4% biomass, and 0.3% geothermal. *Geographical representativeness is characterized as "high".*
Time Coverage	Activity (primary) data is representative of 2022 calendar year (12 months). - Richmond, BC clinker production, - Richmond, BC cement production, - In-bound/out-bound transportation data - primary data collected for Richmond, BC manufacturing plant, - Total carbon dioxide emissions from fuel use and calcination were reported for clinker production as part of the facility data collection. *Temporal representativeness is characterized as "high".*
Completeness	All relevant, specific processes, including inputs (raw materials, energy, and ancillary materials) and outputs (emissions and production volume) were considered and modeled to complete the production profile for Richmond cement products.

Data Quality Requirements	Description
Consistency	To ensure consistency, the modeling of the production input and output LCI data for the Richmond products of interest used the same LCI modeling structure, which consisted of input material and intermediate products, ancillary and packaging materials (if applicable), energy flows, water resource inputs, product outputs, co-products, by-products, emissions to air, water and soil, and solid and liquid waste disposal. The calculated LCI was subsequently inputted into the N.A. version of GCCA Industry EPD tool for Clinker, Cement, Aggregates, Concrete, and Precast products (https://concrete-epd-tool.org). Crosschecks concerning the plausibility of mass and energy flows were continuously conducted. The LCA team conducted mass and energy balances at the facility level and selected process levels to maintain a high level of consistency.
Reproducibility	Internal reproducibility is possible since the data and the models are stored in the N.A. version of GCCA Industry EPD tool for Clinker, Cement, Aggregates, Concrete, and Precast products (https://concrete-epd-tool.org). Key primary (manufacturer specific) and secondary (generic) LCI data sources are also summarized in the GCCA Tool documentation. External reproducibility is not possible as the background report is confidential.
Transparency	Activity and LCI datasets are disclosed in the project report, including all data sources.

Life-Cycle Impact Assessment Results: Richmond, BC OneCem®

This section summarizes the production stage life cycle impact assessment (LCIA) results, including resource use and waste generated metrics, based on the cradle-to-gate life cycle inventory inputs and outputs analysis. The results are calculated based on 1 metric tonne of OneCem® as produced at the Richmond, BC plant.

It should be noted that LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks.

Only EPDs prepared from cradle-to-grave life-cycle results and based on the same function, quantified by the same functional unit, and taking account of replacement based on the product reference service life (RSL) relative to an assumed building service life, can be used to assist purchasers and users in making informed comparisons between products. Environmental declarations from different programs may not be comparable. EPDs are comparable only if they comply with ISO 21930, use the same, sub-category PCR where applicable, include all relevant information modules and are based on equivalent scenarios with respect to the context of construction works.

Production Stage (A1 to A3) EPD Results: Richmond, BC – per metric tonne

Impact category and inventory indicators	Unit	OneCem®
Global warming potential (gross), GWP 100, AR5	kg CO_2 eq	657
Global warming potential (net), GWP 100, AR5	kg CO_2 eq	605
Ozone depletion potential, ODP	kg CFC-11 eq	1.10E-5
Acidification potential, AP	kg SO_2 eq	2.30
Eutrophication potential, EP	kg N eq	0.288
Photochemical oxidant creation potential, POCP	kg O_3 eq	31.3
Abiotic depletion potential for non-fossil mineral resources, $ADP_{elements}$*	kg Sb eq	7.88E-5
Abiotic depletion potential for fossil resources, ADP_{fossil}	MJ NCV	2473
Renewable primary resources used as an energy carrier (fuel), RPR_E*	MJ NCV	324
Renewable primary resources with energy content used as material, RPR_M*	MJ NCV	0
Non-renewable primary resources used as an energy carrier (fuel), $NRPR_E$*	MJ NCV	2473
Non-renewable primary resources with energy content used as material, $NRPR_M$*	MJ NCV	0
Secondary materials, SM*	kg	53.0
Renewable secondary fuels, RSF*	MJ NCV	549
Non-renewable secondary fuels, NRSF*	MJ NCV	622
Net use of freshwater, NFW	m^3	2.514
Hazardous waste disposed, HWD*	kg	0.587
Non-hazardous waste disposed, NHWD*	kg	0.164
High-level radioactive waste, conditioned, to final repository, HLRW*	m^3	ND
Intermediate- and low-level radioactive waste, conditioned, to final repository, ILLRW*	m^3	ND
Components for re-use, CRU*	kg	0
Materials for recycling, MFR*	kg	0.543
Materials for energy recovery, MER*	kg	0
Recovered energy exported from the product system, EE*	MJ NCV	0
Additional Inventory Parameters for Transparency		
Global Warming Potential – Biogenic, GWP_{bio}*	kg CO_2 eq	0.184
Emissions from Calcination and removals from carbonation, CC*	kg CO_2 eq	429
Emissions from Combustion of secondary fuels from Renewable Sources, CWRS*	kg CO_2 eq	0.137
Emissions from combustion of secondary fuels from Non-Renewable Sources, CWNRS*	kg CO_2 eq	52.2

Table Notes:

(ND) Not Declared.

(*) Emerging LCA impact categories and inventory items are still under development and can have high levels of uncertainty that preclude international acceptance pending further development. Use caution when interpreting results for these categories.

LCA Interpretation

The manufacturing module (A3) drives most of the potential environmental impacts. Manufacturing impacts are primarily driven by calcination of limestone (process emissions) followed by thermal energy use used during the pyro-processing of limestone in the production of clinker. Clinker content in cement similarly defines the relative environmental profile of the final cement product. Raw material extraction (A1) is the second largest contributor to the Production Stage EPD results, followed by the transportation (A2).

Additional Environmental Information

At Lafarge, we strive for continuous improvement in our operations and products to reduce our impact on the environment while transforming the entire construction value chain. We are dedicated to playing a role in the transition towards a net-zero and more inclusive future.

Our sustainability program revolves around four key pillars:

Climate and Energy

Circular Economy

Nature

People and Communities

Climate and Energy
We're on a mission to reduce our scope 1, 2, and 3 carbon footprint. By doing so, we're fostering a more sustainable industry and helping our customers reduce the embodied carbon in their buildings and infrastructure over the whole lifecycle.

Targets:

- SBTi validated net-zero targets for 2030 and 2050.
    - Reduce gross scope 1 GHG emissions by 22.4% per ton of cementitious material by 2030, vs. 2018 baseline.
    - Reduce gross scope 2 GHG emissions by 65% per ton cementitious material by 2030, vs. 2018 baseline.
    - Reduce scope 3 GHG emissions from downstream transport and distribution by 24.3% per ton of materials transported by 2030, vs. 2020 baseline.
- Achieve 420kgs CO2/t cementitious material by 2030.

Circular Economy
The circular economy is focused on behaviours and processes that keep materials in use and out of landfill. At Lafarge, we're creating value from waste by transforming it into fuel and raw materials for all our production processes. We use construction and demolition waste as fuel at our cement plants, turn crushed concrete and asphalt into recycled aggregates, create lock blocks out of returned concrete and more.

Targets:

- Use 1.5M tonnes of recycled waste in our production process by the end of 2023.

Nature

Our operations are strongly linked to natural resources, which drives our passion for reducing our environmental impact. We're committed to enhancing biodiversity and championing sustainable land management in the regions we work, all while cutting down on freshwater consumption.

Targets:

- Reduce freshwater withdrawal 25% by 2025, compared to a 2017 baseline through recycling and rainwater harvesting.
- Achieve the following Specific Freshwater Withdrawal targets for 2030:
  - Cement: 205L/tonne.
  - Aggregates: 179L/tonne.
  - Ready Mix: 210L/m^3.
- Have a measurable positive impact on biodiversity, compared to our 2017 baseline through efforts such as progressive reclamation and enhancement projects.

People and Communities

At Lafarge, we put people at the heart of everything we do. We aim to improve the communities in which we live and work by giving back and supporting sustainable, affordable and smart infrastructure.

Targets:

- Improve living standards for all by accelerating access to adequate housing and infrastructure.
- Support communities through initiatives covering health, education and skill building.
- Develop inclusive infrastructure solutions, such as scalable affordable housing and sustainable rural roads.

Note that the targets presented in this section relate to all Lafarge Western Canada operations and are not specific to the Richmond Plant.

References

1. CSA A3000-18 Cementitious materials compendium.
2. ASTM C595/C595M-23 Standard Specification for Blended Hydraulic Cements.
3. ASTM C1157/C1157M-23 Standard Performance Specification for Hydraulic Cement.
4. AASHTO M240M/M240-23 Standard Specification for Blended Hydraulic Cements.
5. NSF International, Product Category Rule for Environmental Product Declarations: PCR for Portland, Blended, Masonry, Mortar, and Plastic (Stucco) Cements v3.2, September 2021.
6. ISO 21930:2017 Sustainability in buildings and civil engineering works - Core rules for environmental product declarations of construction products and services.
7. ASTM General Program Instructions, v8.0, April 29, 2020.
8. GCCA CO2 and Energy Protocol v3.1 (https://www.concrete-co2-protocol.org/en/), December 9, 2013, accessed 08-2021.
9. GCCA Industry EPD tool for Clinker, Cement, Aggregates, Concrete, and Precast products, N.A. version 4.1 (https://concrete-epd-tool.org) accessed 10-2023.
10. GCCA Industry EPD tool for Clinker, Cement, Aggregates, Concrete, and Precast products (v4.1) LCA Model, North American Version, October 9, 2023.
11. GCCA Industry EPD tool for Clinker, Cement, Aggregates, Concrete, and Precast products (v4.1) LCA Database, October 9, 2023.
12. GCCA Industry EPD tool for Clinker, Cement, Aggregates, Concrete, and Precast products, Verification Report – GCCA Industry EPD Tool for Cement and Concrete (v4.1), October 12, 2023.