Environmental Product Declaration (EPD) for Cement Produced at Bellingham Cement Grinding Plant

GENERAL INFORMATION

This cradle to gate Environmental Product Declaration covers three cement products produced at the Bellingham Cement Grinding Plant. The Life Cycle Assessment (LCA) was prepared in conformity with ISO 21930, ISO 14025, ISO 14040, and ISO 14044. This EPD is intended for business-to-business (B-to-B) audiences.

LEHIGH CEMENT

Bellingham Cement Grinding Plant and Terminal
741 Marine Dr.
Bellingham, WA. 98225

PROGRAM OPERATOR

National Ready Mixed Concrete Association
900 Spring Street
Silver Spring, MD 20910
https://www.nrmca.org/

NRMCAEPD: 20033

DATE OF ISSUE

June 1, 2020 (valid for 5 years until June 1, 2025)

ENVIRONMENTAL IMPACTS

Lehigh Bellingham Plant: Product-Specific Type III EPD

Declared Cement Products (three):
Type IL/GUL; Type I/II/GU; Type III/HE

Declared Unit: One metric tonne of cement

	CEMENT PRODUCTS TYPE IL/GUL	TYPE I/II/GU	TYPE III/HE
Global Warming Potential (kg CO_2-eq)	713	783	792
Ozone Depletion Potential (kg CFC-11-eq)	2.25E-05	2.43E-05	2.52E-05
Eutrophication Potential (kg N-eq)	0.79	0.84	0.93
Acidification Potential (kg SO_2-eq)	2.74	3.01	3.02
Photochemical Ozone Creation Potential (kg O_3-eq)	78.6	86.3	86.3
Abiotic Depletion, nonfossil (kg Sb-eq)	1.16E-05	1.27E-05	1.28E-05
Abiotic Depletion, fossil (MJ)	3,490	3,803	3,937
Product Components:			
Clinker	82%	91%	90%
Limestone, Gypsum and Others	18%	9%	10%

Additional detail and impacts are reported on page 5

ISO 21930:2017 Sustainability in Building Construction-Environmental Declaration of Building Products: serves as the core PCR NSF PCR for Portland, Blended, Masonry, Mortar, and Plastic (Stucco) Cements V2: serves as the sub-category PCR
Sub-category PCR review was conducted by Thomas P. Gloria, PhD. (t.gloria@industrial-ecology.com) • Industrial Ecology Consultants
Independent verification of the declaration, according to ISO 21930:2017 and ISO 14025:2006.: ☐ internal ☑ external
Third party verifier Lindita Bushi, Ph.D. (lindita.bushi@athenasmi.org) • Athena Sustainable Materials Institute
For additional explanatory material Manufacture Representative: Ignacio Cariaga (Ignacio.Cariaga@lehighhanson.com) This LCA EPD was prepared by: Laurel McEwen, VP EPD Services • Climate Earth (www.climateearth.com)
Environmental declarations from different programs may not be comparable. EPDs are comparable only if they comply with ISO 21930 (2017), 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.

LIFE CYCLE ASSESSMENT

PRODUCER

Lehigh Cement is a leading supplier of cementitious construction materials in North America. The Bellingham plant started operation in May 1913, under the name Olympic Portland Cement. The cement plant was one of Bellingham's largest employers until the 1950s. The plant stopped producing clinker in 1987. The Bellingham plant is now a cement grinding facility and fly ash distribution location. The Bellingham plant receives all of its clinker from the Lehigh plant in Delta, British Columbia. Raw materials for cement production are received by rail, truck and barge into the Port of Bellingham. Water and rail access helps mitigate our environmental impacts through efficient and more sustainable transportation of raw materials and delivery of cement. Lehigh Cement's commitment to sustainable construction includes actively working to create lower carbon cements through supplementary cementitious materials (SCMs) and alternative raw materials and fuels. Consistent with HeidelbergCement's vision of reducing greenhouse gas (GHG) emissions to have carbon neutral concrete by 2050, Lehigh has developed product and plant specific EPDs as baselines for its embodied carbon.

The health and well-being of our employees, communities and the natural environment are vital to our success. In Bellingham, Lehigh supports Alderwood Elementary School with an annual donation which helps the school provide much needed meals and access to the music, art and sports programs. Alderwood Elementary is less than one mile from the plant, the annual donation has a positive impact on the community in which we operate.

PRODUCT

The cement products covered in this EPD meet UN CPC 3744 classification and the following standards:

Product Type	Applicable Standard	Standard Designation
Portland Limestone (General Use Limestone) Cement	ASTM C595, C1157, AASHTO M240	Type IL
	CSA A3001	Type GUL
Portland (General Use) Cement	ASTM C150, C1157, AASHTO M85	Type I/II
	CSA A3001	Type GU
High Early Cement	ASTM C150, C1157, AASHTO M85	Type III
	CSA A3001	Type HE

PRODUCT DESCRIPTION

This EPD reports environmental transparency information for three cement products, produced by Lehigh Cement at their Bellingham, WA grinding facility. These cements are hydraulic binders and are manufactured by grinding cement clinker and other main or minor constituents into a finely ground, usually grey colored mineral powder. Cement is just one ingredient in the mixture that creates concrete, but it is the most chemically active ingredient and crucial to the quality of the final product. When mixed with water, cement acts as a glue to bind together the sand, gravel or crushed stone to form concrete, one of the most durable, resilient and widely used construction materials in the world. Our Type IL/GUL is branded as **EcoCem*PLC*™** and was developed to be more environmentally friendly by reducing its carbon footprint (reduction measured through GWP). This product is a general use product for concrete and mortar as well as all the other various applications for cement**,** including engineered soils and solidification/stabilization of materials and wastes.

DECLARED UNIT

The declared unit is one metric tonne of Type IL, Type I/II and TYPE III cement.

SYSTEM BOUNDARY

This EPD is a cradle-to-gate EPD covering A1-A3 stages of the life cycle.

PRODUCTION STAGE			CONSTRUCTION STAGE		USE STAGE							END OF LIFE STAGE			
Extraction and upstream production	Transport to Factory	Manufacturing	Transport to site	Installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction / Demolition	Transport	Waste Processing	Disposal of Waste
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4
X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND

Note: MND = module not declared; X = module included.

CUT-OFF

Items excluded from 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); and
- energy and water use related to company management and sales activities that may be located either within the factory site or at another location.

ALLOCATION PROCEDURE

Allocation follows the requirements and guidance of ISO 14044:2006, Clause 4.3.4; NSF PCR:2020; and ISO 21930:2017 section 7.2. Recycling and recycled content is modeled using the cut-off rule.

This sub-category PCR recognizes fly ash, silica fume, granulated blast furnace slag, cement kiln dust, flue gas desulfurization (FGD) gypsum, and post-consumer gypsum 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.

LIFE CYCLE INVENTORY (LCI)

Primary Sources of LCI Data:

Barge transport: ecoinvent 3.5 (2018) "Transport, freight, inland waterways, barge {RoW}| market for transport, freight, inland waterways, barge | Cut-off, U"
Clinker: primary data (2020) "Lehigh Hanson Delta Cement Plant and Terminal, Delta, BC"
Electricity: Ecoinvent 3.5 (2018) "Electricity, high voltage {WECC, US only}| market for | Cut-off, U"
Gypsum: ecoinvent 3.5 (2018) "Gypsum, mineral {GLO}| market for | Cut-off, U"
Limestone: ecoinvent 3.5 (2018) "Limestone, crushed, for mill {CA-QC}| production | Cut-off, U"
Ocean transport: ecoinvent 3.5 (2018) "Transport, freight, sea, transoceanic ship {GLO}| market for | Cut-off, U"
Rail transport: ecoinvent 3.5 (2018) "Transport, freight train {US}| market for | Cut-off, U"
Truck transport: USLCI (2015) "Transport, combination truck, long-haul, diesel powered, Northwest/tkm/RNA"
Truck transport: USLCI (2015) "Transport, combination truck, short-haul, diesel powered, Northwest/tkm/RNA"

Electricity grid mix includes: 29.2% Natural Gas, 22.6% Hydro, 14.3% Lignite, 13.9% Coal, 8.1% Nuclear, 6.6% Wind, 2.2 Geothermal, 1.7% BC import, 0.6% Wood Chips, 0.4% Biogas, 0.3% Solar with a global warming potential of 0.50 kg CO_2eq per kWh.

Clinker calcination emissions were calculated based on the Cement CO2 and Energy Protocol detailed output method (B2) published by the World Business Council for Sustainable Development (WBCSD) Cement Sustainability Initiative (CSI). All cement kiln dust is recycled back into kiln.

REFERENCES

Climate Earth 2020: Lehigh Cement – LCA Project Report, Delta and Bellingham Plants
ecoinvent v3.5: 2018 The Swiss Centre for Life Cycle Inventories
ISO 21930:2017 Sustainability in buildings and civil engineering works — Core rules for environmental product declarations of construction products and services
ISO 14044:2006 Environmental Management - Life Cycle Assessment - Requirements and Guidelines
ISO 14040:2006 Environmental Management - Life Cycle Assessment - Principles and Framework
NSF 2020: PCR for Portland, Blended, Masonry, Mortar and Plastic (Stucco) Cements v3, May 2020
USLCI: 2015 The U.S. Life Cycle Inventory Database
WBCSD CSI 2013: CO2 and Energy Protocol Version 3.1 of 9 December 2013; https://www.cement-co2-protocol.org/en/

LIFE CYCLE IMPACT ASSESSMENT RESULTS – Bellingham Cement Products: Type IL (GUL) named EcoCem*PLC*™, Type I/II (GU) and Type III (HE); per 1 metric tonne

Impact Assessment	Unit	GUL (Type IL)	GU (Type I/II)	HE (Type III)
Global warming potential (GWP)[1]	kg CO_2 eq	**713**	**783**	**792**
Depletion potential of the stratospheric ozone layer (ODP)	kg CFC-11 eq	**2.25E-05**	**2.43E-05**	**2.52E-05**
Eutrophication potential (EP)	kg N eq	**0.79**	**0.84**	**0.93**
Acidification potential of soil and water sources (AP)	kg SO_2 eq	**2.74**	**3.01**	**3.02**
Formation potential of tropospheric ozone (POCP)	kg O_3 eq	**78.6**	**86.3**	**86.3**
Resource Use				
Abiotic depletion potential for non-fossil mineral resources (ADPelements)*	kg Sb eq	**1.16E-05**	**1.27E-05**	**1.28E-05**
Abiotic depletion potential for fossil resources (ADPfossil)	MJ, NCV	**3,490**	**3,803**	**3,937**
Renewable primary energy resources as energy (fuel), (RPRE)*	MJ, NCV	**670**	**728**	**764**
Renewable primary resources as material, (RPRM)*	MJ, NCV	**0.00**	**0.00**	**0.00**
Non-renewable primary resources as energy (fuel), (NRPRE)*	MJ, NCV	**3,690**	**4,015**	**4,178**
Non-renewable primary resources as material (NRPRM)*	MJ, NCV	**0.00**	**0.00**	**0.00**
Consumption of fresh water	m3	**3.11**	**3.35**	**3.40**
Secondary Material, Fuel and Recovered Energy				
Secondary Materials, (SM)*	kg	**10.0**	**15.0**	**15.0**
Renewable secondary fuels, (RSF)*	MJ, NCV	**242**	**268**	**267**
Non-renewable secondary fuels (NRSF)*	MJ, NCV	**121**	**134**	**133**
Recovered energy, (RE)*	MJ, NCV	**0.00**	**0.00**	**0.00**
Waste & Output Flows				
Hazardous waste disposed*	kg	**0.03**	**0.03**	**0.03**
Non-hazardous waste disposed*	kg	**0.35**	**0.37**	**0.37**
High-level radioactive waste*	kg	**4.32E-08**	**4.29E-08**	**5.88E-08**
Intermediate and low-level radioactive waste*	kg	**1.22E-06**	**1.26E-06**	**1.40E-06**
Components for reuse*	kg	**0.00**	**0.00**	**0.00**
Materials for recycling*	kg	**0.07**	**0.07**	**0.07**
Materials for energy recovery*	kg	**4.06E-05**	**4.49E-05**	**4.47E-05**
Recovered energy exported from the product system*	MJ, NCV	**0.00**	**0.00**	**0.00**
Additional Inventory Parameters for Transparency				
Emissions from calcination and uptake from carbonation	kg CO_2 eq	**420**	**465**	**463**
Biogenic CO_2, reporting the removals and emissions associated with biogenic carbon content contained within biobased products[2]	kg CO_2 eq	**0.00**	**0.00**	**0.00**

* 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 data in these categories.

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.

[1] GWP 100; 100-year time horizon GWP factors are provided by the IPCC 2013 Fifth Assessment Report (AR5).
CO2 from biomass secondary fuels (wood chips made from construction waste as well as whole wood construction waste) used in kiln are climate-neutral (CO2 sink = CO2 emissions), ISO 21930, 7.2.7.

[2] **GUL**, biogenic CO2= 0 (- 29 kg CO2e/+29 kg CO2e); **GU**, biogenic CO2= 0 (- 32 kg CO2e/+32 kg CO2e); **HE**, biogenic CO2= 0 (- 32 kg CO2e/+32 kg CO2e).

ADDITIONAL ENVIROMENTAL INFORMATION

Environmental Management System (EMS)

The Bellingham Grinding Plant has processes in place which identifies environmental impacts and related best management practices and controls. These policies and procedures are continually reviewed and updated to reflect current environmental knowledge and regulations. The various plans provide plant personnel with information on environmental procedures and requirements.

- Site Specific Emergency Management Plan
- Spill Prevention, Control, and Countermeasures Plan
- Stormwater Pollution Prevention Plan
- Operations and Maintenance Plan for Air Emission Sources
- Solid Waste Control Plan

For environmental reporting the plant complies with Washington State and United States federal requirements and reporting. The Plant maintains a Title V Air Operating Permit (AOP 022R1) issued by the Northwest Clean Air Agency (NWCAA) in accordance with the provisions of the Regulation of the NWCAA and Chapter 173-401 of the Washington Administrative Code. The permit also requires compliance with the federal New Source Performance Standards (NSPS) and the National Emission Standards for Hazardous Air Pollutants (NESHAP). Emissions reporting is completed annually through the Washington Emissions Inventory Reporting System.

The Plant maintains a Tier II inventory and submits annual reports to the Washington Department of Ecology, Whatcom County, and the local fire department under the Community-Right-to-Know reporting program.

The Plant maintains a Solid Waste Control Plan which outlines the proper handling, management, and disposal requirements for general office waste, universal waste (e.g. batteries, light bulbs, scrap metal), electronics, and hazardous materials (e.g. waste oil, waste chemicals, oily rags, etc.).

Sustainability Commitments

Lehigh Cement, a Lehigh Hanson affiliated company, is a part of the HeidelbergCement Group, a leading construction materials company worldwide. HeidelbergCement's Sustainability Commitments 2030 define the key topics and core principles of Lehigh Cement's sustainability strategies, aligning with the UN Assembly Sustainable Development Goals (SDGs). Company sustainability performance ratings and ranking are publicly available at https://www.heidelbergcement.com/en/sustainability-report.

Lehigh Cement supports HeidelbergCement's Sustainability Commitments 2030. HeidelbergCement's goal of a 30% carbon footprint reduction as compared to 1990, encourages the discovery of innovative approaches and thought processes to reduce environmental impacts and ensure a sustainable business model. Working to incorporate knowledge and practices learned from global resources for local applications, Lehigh Cement continuously innovates to improve services and products that increase efficiency on the jobsite. Lehigh Cement also strives for effective management of all processes and resources and works with the local communities to promote resilient infrastructure and provide increased transparency. Lehigh Cement aligns and works globally with HeidelbergCement to push toward carbon neutral concrete by 2050. To learn more about Lehigh Cement's sustainability commitment, visit https://www.lehighhanson.com/about/sustainability.