Environmental Product Declaration (EPD) for Cement Produced at Edmonton Cement Plant

GENERAL INFORMATION

This cradle to gate Environmental Product Declaration covers five cement products produced at the Edmonton Cement 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

Edmonton Cement Plant and Terminal
12640 Inland Way
Edmonton, AB T5V 1K2

PROGRAM OPERATOR

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

NRMCAEPD: 20036

DATE OF ISSUE

October 15, 2020 (valid for 5 years until October 15, 2025)

ENVIRONMENTAL IMPACTS

Lehigh Edmonton Plant: Product-Specific Type III EPD

Declared Cement Products (five):
GULb/HSLb; GU/Type 10; HE/Type 30; HS/Type 50; OWG

Declared Unit: One metric tonne of cement

	CEMENT PRODUCTS				
	GULb HSLb	GU Type 10	HE TYPE 30	HS TYPE 50	OWG
Global Warming Potential (kg CO_2-eq)	**632**	**816**	**886**	**836**	**842**
Ozone Depletion Potential (kg CFC-11-eq)	2.92E-05	3.81E-05	4.04E-05	3.92E-05	3.95E-05
Eutrophication Potential (kg N-eq)	1.81	1.94	2.62	2.13	1.95
Acidification Potential (kg SO_2-eq)	2.34	2.99	3.25	3.16	3.10
Photochemical Ozone Creation Potential (kg O_3-eq)	50.9	66.3	69.9	69.7	68.7
Abiotic Depletion, nonfossil (kg Sb-eq)	1.59E-06	2.07E-06	2.23E-06	2.16E-06	2.19E-06
Abiotic Depletion, fossil (MJ)	3,926	4,887	5,488	5,138	5,033
Product Components:					
Clinker	67%	90%	93%	90%	94%
Limestone, Gypsum and Others	13%	10%	7%*	10%	6%*
Fly Ash	20%	0%	0%	0%	0%

*Does not contain limestone

Additional detail and impacts are reported on pages 5-6

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 V3.1 serves as the sub-category PCR Inclusion of API SPEC 10A under the scope of PCA PCR effective 9/11/2020 per NSF Deviation #2020-037
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)
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, a leading supplier of cementitious construction materials in North America, has been manufacturing cement in Canada for more than 100 years. We operate cement plants in Edmonton, Alberta; Delta, British Columbia; and Picton, Ontario; and we are a pillar of the many communities around us, providing employment and economic benefit to small towns and cities. Our state-of-the-art Edmonton plant is located in the northwest portion of the city and has produced cement at this location since 1955. Lehigh Cement's commitment to sustainable construction includes actively working to develop lower carbon cements through the utilization of wastes, 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.

Lehigh Cement is a founding and active member in the City of Edmonton Corporate Climate Leaders program and Alberta Capital Airshed (ACA) and works voluntarily with the community on environmental impacts and GHG management. The Edmonton plant has been fortunate enough to be called home by Peregrine Falcons since 1992. Falcons began roosting at the plant when the species was listed as endangered on Canada's Endangered Species List. The falcons raise chicks every year and at times adopt young from nests located in less successful sites elsewhere in the province. The prosperous breeding success of the pair at the Edmonton site has helped the Peregrine's numbers recover and they are no longer considered an Endangered Species. Lehigh has also helped raise awareness of the importance of biodiversity through the development of a Conservation Easement at its Kinokamau Lake wetland located in the plant's clay quarry. Our Cadomin Limestone Quarry works with researchers assessing grizzly bear and bat populations around the quarry. Both of these projects gained global recognition through HeidelbergCement's Quarry Life Award program.

PRODUCT

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

Product Type	Applicable Standard	Standard Designation - Lehigh Brand Name
General Use Limestone Blended (Portland) Cement	CSA A3001	Type GULb / HSLb – EcoCem®*PLUS*
General Use (Portland) Cement	CSA A3001	Type GU / Type 10
High Early Cement	CSA A3001	Type HE / Type 30
Sulfate Resistant Cement	CSA A3001	Type HS / Type 50
Oilwell Cement	API Spec 10A	Oil Well Cement Class G (OWG)

PRODUCT DESCRIPTION

This EPD reports environmental transparency information for five cement products, produced by Lehigh Cement at their Edmonton, Alberta, 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 environmentally friendly product is branded as **EcoCem®*PLUS*** and was developed to reduce embodied carbon (measured through GWP). This product is a general use limestone blended (GULb) and a high sulfate (HSLb) resistant 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. The Lehigh Edmonton plant oil well cement conforms to an American Petroleum Institute (API) Spec 10A Class G. This cement is used for oil well grouting or cementing and is able to withstand high temperatures and pressures of deep wells.

DECLARED UNIT

The declared unit is one metric tonne of GULb/HSLb, GU, HE, HS and OWG 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:

Electricity: ecoinvent 3.5 (2018) "Electricity, medium voltage {CA-AB}| 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"
Natural Gas: ecoinvent 3.5 (2018) "market for natural gas, high pressure CA-AB"
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"
Sand: ecoinvent 3.5 (2018) "Silica sand {RoW}| production | Cut-off, U"
Truck transport: USLCI (2015) "Transport, combination truck, long-haul, diesel powered, West North Central/tkm/RNA"
Truck transport: USLCI (2015) "Transport, combination truck, short-haul, diesel powered, West North Central/tkm/RNA"

Electricity grid mix includes: 64.2% Coal, 23.3% Natural Gas, 5.2% Wind, 2.0% British Columbia import, 2.8% Hydro, 1.4% WECC import, 0.8% Wood with a global warming potential of 0.89 kg CO2e/kWh.

Edmonton's direct greenhouse gas (GHG) emissions were calculated based on the Alberta Environment and Parks standard for stationary combustion GHG emissions reporting. Calcination emissions were calculated based on the Cement CO_2 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, Edmonton Plant
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 v3.1, September 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/
Alberta Environment and Parks 2020: Quantification Methodologies for the Carbon Competitiveness Incentive Regulation and Specified Gas Reporting Regulation.

LIFE CYCLE IMPACT ASSESSMENT RESULTS – Edmonton Cement Products: Type GULb/HSLb named EcoCem®*PLUS* and Type GU/Type 10 (per 1 metric tonne)

Impact Assessment	Unit	EcoCem®*PLUS*	GU (Type 10)
Global warming potential (GWP)[1]	kg CO_2 eq	**632**	**816**
Depletion potential of the stratospheric ozone layer (ODP)	kg CFC-11 eq	**2.92E-05**	**3.81E-05**
Eutrophication potential (EP)	kg N eq	**1.81**	**1.94**
Acidification potential of soil and water sources (AP)	kg SO_2 eq	**2.35**	**2.99**
Formation potential of tropospheric ozone (POCP)	kg O_3 eq	**50.9**	**66.3**
Resource Use			
Abiotic depletion potential for non-fossil mineral resources (ADPelements)*	kg Sb eq	**1.59E-06**	**2.07E-06**
Abiotic depletion potential for fossil resources (ADPfossil)	MJ, NCV	**3,926**	**4,887**
Renewable primary energy resources as energy (fuel), (RPRE)*	MJ, NCV	**83.2**	**89.3**
Renewable primary resources as material, (RPRM)*	MJ, NCV	**0**	**0**
Non-renewable primary resources as energy (fuel), (NRPRE)*	MJ, NCV	**3,943**	**4,909**
Non-renewable primary resources as material (NRPRM)*	MJ, NCV	**0**	**0**
Consumption of fresh water	m3	**0.26**	**0.31**
Secondary Material, Fuel and Recovered Energy			
Secondary Materials, (SM)*	kg	**271**	**96.0**
Renewable secondary fuels, (RSF)*	MJ, NCV	**2.14**	**2.91**
Non-renewable secondary fuels (NRSF)*	MJ, NCV	**7.08**	**9.61**
Recovered energy, (RE)*	MJ, NCV	**0**	**0**
Waste & Output Flows			
Hazardous waste disposed*	kg	**9.92E-04**	**1.13E-03**
Non-hazardous waste disposed*	kg	**0.03**	**0.04**
High-level radioactive waste*	kg	**4.53E-09**	**4.99E-09**
Intermediate and low-level radioactive waste*	kg	**7.51E-07**	**9.35E-07**
Components for reuse*	kg	**2.67E-04**	**3.10E-04**
Materials for recycling*	kg	**0.03**	**0.03**
Materials for energy recovery*	kg	**2.03E-04**	**2.32E-04**
Recovered energy exported from the product system*	MJ, NCV	**0**	**0**
Additional Inventory Parameters for Transparency			
Emissions from calcination and uptake from carbonation	kg CO_2 eq	**334**	**453**
Biogenic CO_2, reporting the emissions from combustion of waste from renewable sources used in production processes[2]	kg CO_2 eq	**0**	**0**

* 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] **EcoCem®*PLUS***, biogenic CO2= 0 (- 0.20 kg CO2e/+0.20 kg CO2e); **GU**, biogenic CO2= 0 (- 0.27 kg CO2e/+0.27kg CO2e).

LIFE CYCLE IMPACT ASSESSMENT RESULTS – Edmonton Cement Products: HE/Type 30, HS/Type 50 and Oil Well/OWG (per 1 metric tonne)

Impact Assessment	Unit	HE (Type 30)	HS (Type 50)	Oil Well (OWG)
Global warming potential (GWP)[3]	kg CO_2 eq	**886**	**836**	**842**
Depletion potential of the stratospheric ozone layer (ODP)	kg CFC-11 eq	**4.04E-05**	**3.92E-05**	**3.95E-05**
Eutrophication potential (EP)	kg N eq	**2.62**	**2.13**	**1.95**
Acidification potential of soil and water sources (AP)	kg SO_2 eq	**3.25**	**3.16**	**3.10**
Formation potential of tropospheric ozone (POCP)	kg O_3 eq	**69.9**	**69.7**	**68.7**
Resource Use				
Abiotic depletion potential for non-fossil mineral resources (ADPelements)*	kg Sb e	**2.23E-06**	**2.16E-06**	**2.19E-06**
Abiotic depletion potential for fossil resources (ADPfossil)	MJ, NCV	**5,488**	**5,138**	**5,033**
Renewable primary energy resources as energy (fuel), (RPRE)*	MJ, NCV	**120**	**99.2**	**91.2**
Renewable primary resources as material, (RPRM)*	MJ, NCV	**0**	**0**	**0**
Non-renewable primary resources as energy (fuel), (NRPRE)*	MJ, NCV	**5,512**	**5,164**	**5,059**
Non-renewable primary resources as material (NRPRM)*	MJ, NCV	**0**	**0**	**0**
Consumption of fresh water	m3	**0.33**	**0.45**	**0.45**
Secondary Material, Fuel and Recovered Energy				
Secondary Materials, (SM)*	kg	**99.0**	**137**	**143**
Renewable secondary fuels, (RSF)*	MJ, NCV	**3.00**	**2.90**	**3.01**
Non-renewable secondary fuels (NRSF)*	MJ, NCV	**9.91**	**9.57**	**9.95**
Recovered energy, (RE)*	MJ, NCV	**0**	**0**	**0**
Waste & Output Flows				
Hazardous waste disposed*	kg	**1.15E-03**	**1.13E-03**	**1.15E-03**
Non-hazardous waste disposed*	kg	**0.04**	**0.05**	**0.05**
High-level radioactive waste*	kg	**6.55E-09**	**5.91E-09**	**5.52E-09**
Intermediate and low-level radioactive waste*	kg	**9.66E-07**	**1.09E-06**	**1.01E-06**
Components for reuse*	kg	**2.67E-04**	**3.05E-04**	**3.05E-04**
Materials for recycling*	kg	**0.03**	**0.03**	**0.03**
Materials for energy recovery*	kg	**2.36E-04**	**2.32E-04**	**2.36E-04**
Recovered energy exported from the product system*	MJ, NCV	**0**	**0**	**0**
Additional Inventory Parameters for Transparency				
Emissions from calcination and uptake from carbonation	kg CO_2 eq	**467**	**451**	**469**
Biogenic CO_2, reporting the emissions from combustion of waste from renewable sources used in production processes[4]	kg CO_2 eq	**0**	**0**	**0**

* 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.

[3] 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.

[4] **HE**, biogenic CO2= 0 (- 0.28 kg CO2e/+0.28 kg CO2e); **HS**, biogenic CO2= 0 (- 0.27 kg CO2e/+0.27 kg CO2e; **OWG**, biogenic CO2= 0 (- 0.29 kg CO2e/+0.29 kg CO2e).

ADDITIONAL ENVIROMENTAL INFORMATION

Environmental Management System (EMS) and Reporting

The Edmonton plant has an EMS in place. The EMS identifies environmental impacts and ensures that control procedures are maintained to reflect current environmental knowledge and regulations.
For environmental reporting, the plant complies with the Albertan and Canadian environmental compliance requirements and emissions reports:

- Canadian National Pollutant Release Inventory (NPRI)
- Greenhouse Gas Reporting:
    - Alberta's Climate Change Legislation- Technology Innovation & Emissions Reduction (TIER) legislation
    - Environment & Climate Change Canada (ECCC) and Partner's Greenhouse Gas Reporting

Operating Approval

The Edmonton plant operates under an Operating Approval (#10339), issued by the Province under the Environmental Protection and Enhancement Act.

Recycling Programs

The Edmonton plant offers an impacted clay recycling/reuse program in which impacted clay is reused to manufacture clinker in place of mining and utilizing virgin clay. This program has resulted in over 200,000 tonnes of clay being diverted from landfill to the Edmonton plant yielding a savings in GHG emissions related to the material decomposition and the avoidance of transportation to distant landfills.

We recycle all process water collected and treated in the process pond. The process pond also helps collect stormwater for reuse in the manufacturing process. There is no process wastewater discharge from the plant.

The Edmonton plant sorts and stores onsite the following used materials for recycling: batteries, aerosol cans, discarded paper and cardboard, non-functional electronic hardware, parts, light ballasts and bulbs. The sorted recyclable materials are recycled offsite through contractors.

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.