Ciment Québec

Ciment Québec Inc's ELEMENT™ Portland, Portland-Limestone and Blended Cements

CIMENT QUÉBEC INC.

ENVIRONMENTAL PRODUCT DECLARATION

ISO 14025:2006

ASTM INTERNATIONAL

Ciment Québec Inc. (CQI). is pleased to present this environmental product declaration (EPD) for their Portland, Portland-Limestone and Blended Cements. This EPD was developed in compliance with CAN/CSA-ISO 14025 and has been verified by Lindita Bushi, Athena Sustainable Materials Institute.

The LCA and the EPD were prepared by Vertima Inc. The EPD includes cradle-to-gate life cycle assessment (LCA) results.

For more information about Ciment Québec Inc, visit www.cimentquebec.com
For any explanatory material regarding this EPD, please contact the program operator.

1 General Information

PCR GENERAL INFORMATION			
Reference PCR	PCR for Portland, Blended, Masonry, Mortar, and Plastic (Stucco) Cements NSF International, version 3.1 September 2020 to March 2025		
The PCR review was conducted by:	*Thomas P. Gloria, Ecology Consultants (Chairperson)* *t.gloria@industrial-ecology.com*	*Jack Geibig, ECOForm* *Jgeigib@ecoform.com*	*Mr. Bill Stough, Sustainable Research Group* *bstough@subtainableresearchgroup.com*

EPD GENERAL INFORMATION		
Program Operator	ASTM International 100 Barr Harbor Drive, West Conshohocken, PA 19428 USA www.astm.org	
Declared Product	ELEMENT™ Portland Cement: GU Type I, MS Type I/II, Type II ProBase™, Rehab-Sol™; ELEMENT™ Portland Cement: HE Type III; ELEMENT™ Portland Cement: GU-PER; ELEMENT™ Portland-Limestone Cement: GUL / IL; and ELEMENT™ Blended Portland Cement: GUb-SF / CompactCem™.	
EPD Registration Number EPD - 231	**EPD Date of Issue** June 2021	**EPD Period of Validity** June 2021 - June 2026
EPD Recipient Organization	Ciment Québec Inc. 145, du Centenaire Blvd Saint-Basile (Quebec) G0A 3G0 CANADA http://www.cimentquebec.com	
EPD Type/Scope and Declared Unit Product specific cradle-to-gate EPD with declared unit of 1 metric tonne (1000 kg) of cement		**Year of Reported Manufacturer Primary Data** 2019
LCA Software Open LCA v.1.10.3	**LCI Databases** ecoinvent 3.7 and US LCI	**LCI Methodology** TRACI 2.1, CML 4.8

This LCA and EPD were prepared by:	Chantal Lavigne, M.A.Sc. Vertima Inc. www.vertima.ca
This EPD and LCA were independently verified in accordance with ISO 14025:2006 and ISO 21930:2017. 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 subcategory PCR. ☐ Internal ☒ External	____________________ Lindita Bushi, Ph.D. Athena Sustainable Materials Institute

LIMITATIONS

Environmental declarations from different programs (ISO 14025) may not be comparable [3].

"Only EPDs prepared form 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]

2 Product System Description

Ciment Québec Inc. (CQI) is an integrated cement group that includes several divisions in the cement, concrete and aggregate sectors. Its cement manufacturing facility is based in Saint-Basile (Quebec), Canada.

2.1 PRODUCT DESCRIPTION AND MATERIAL COMPOSITION

Cement is largely used in concrete production and is made of clinker, gypsum, limestone and other additives. In this EPD, multiple types of Portland cements with similar formulations, as provided in Table 1, as well as Portland-Limestone cements and Blended Portland cements produced by Ciment Québec, are studied. Some Portland cements have the same composition but can be found under different brand names, such as cement GU Type I, MS Type I/II, Type II, ProBase™, RehabSol™.

Table 1: Material composition of ELEMENT™ Portland Cement, ELEMENT™ Portland-Limestone Cement and ELEMENT™ Blended Portland Cement.

	ELEMENT™ Portland Cement			ELEMENT™ Portland-Limestone Cement	ELEMENT™ Blended Cement
Cement types: / Materials	GU Type I MS Type I/II Type II ProBase™, RehabSol™	HE Type III	GU-PER	GUL / IL	GUb-SF / CompactCem™
Clinker	90.3%	89.5%	87.5%	75.5%	81.0%
Gypsum	6.4%	7.3%	8.0%	7.0%	6.4%
Limestone	3.3%	3.2%	4.5%	13.5%	4.6%
Silica Fume	0.0%	0.0%	0.0%	0.0%	8.0%
Additives	< 1%	< 1%	< 1%	< 1%	< 1%

According to ASTM C219, Standard Terminology Relating to Hydraulic and Other Inorganic Cements, and as reported in the PCR, section 3, the cement under analysis can be defined as followed:

- Portland cement: hydraulic cement produced by pulverizing clinker, consisting essentially of crystalline hydraulic calcium silicates, and usually containing one or more of the following: water, calcium sulfate, up to 5% limestone, and processing additions (ASTM C219).
- Portland-limestone cement: hydraulic cement consisting of an intimate and uniform blend of Portland cement and limestone produced by intergrinding Portland cement clinker and limestone; by blending Portland cement and finely divided limestone; or by a combination of intergrinding and blending in which the amount of the limestone constituent is within specified limits (ASTM C219).
- Blended hydraulic cement: hydraulic cement consisting of two or more inorganic constituents (at least one of which is not Portland cement or Portland cement clinker) which separately or in combination contribute to the cement's strength-gaining properties (made with or without other constituents, processing additions and functional additions, by intergrinding or other blending) (ASTM C219).

ELEMENT™ Portland, Portland-Limestone and Blended Portland cements respect the standards listed in Table 2. Typical cement certification and safety data sheets are available at https://cimentquebec.com/en/cement/product-line/portland-cement/.

Table 2: ELEMENT™ Portland Cement, ELEMENT™ Portland-Limestone Cement and ELEMENT™ Blended Portland Cement performance characteristics.

Cement types (Standard Designation and Brand Names)	Applicable Standard
ELEMENT™ Portland Cement (GU Type I, MS Type I/II, Type II, ProBase™, RehabSol™, HE Type III, GU-PER)	**ASTM C150/C150M**, Standard Specification for Portland Cement **ASTM C1157/C1157M**, Performance Specification for Hydraulic Cement **AASHTO M 85**, Standard Specification for Portland Cement or **CSA A3001**, Cementitious Materials for Use in Concrete
ELEMENT™ Portland Limestone Cement (GUL / IL)	**ASTM C595/C595M**, Standard Specification for Blended Hydraulic Cements **ASTM C1157/C1157M**, Performance Specification for Hydraulic Cement **AASHTO M 240**, Standard Specification for Blended Hydraulic Cement or **CSA A3001**, Cementitious Materials for Use in Concrete
ELEMENT™ Blended Cement (GUb-SF / CompactCem™)	

2.2 MANUFACTURING

At Ciment Québec, the limestone quarry is adjacent to the cement plant. Travel distance is thus minimized. The stone is first reduced to 125 mm, then to 65 mm, as it moves through primary and secondary crushers, and finally it is stored. The stone is chemically analysed on a continuous, real-time basis, which allows for a precise dosage of high and low calcium carbonate content stone as required by the standards.

The mix of stones and other components is pulverized using the roller crusher, which results in a fine stone powder called raw meal. The heat recovered from the pre-heating tower is used to dry the raw meal and to extract the material outside the crusher. Some 50 dust removers are installed strategically throughout the plant. The dust is recovered and re-used in the production process.

Upon exiting the crusher, the raw meal is stored in silos where it is constantly moved by powerful air blasts to homogenize the mixture. The next steps are part of Ciment Québec's Synergia™ process. The raw meal is sent to the pre-heating tower, where it is heated up from 90˚C to 900˚C, and calcination occurs during this short phase in the extended calcination furnace, where more than 60% of the total heat energy is introduced in the process. To heat the raw meal, Ciment Québec added a solid fuel reactor known as an Eco-Furnace. This reactor burns various solid materials, such as used tires. The heat generated through combustion in the reactor is introduced into the cooking circuit, thereby reducing the use of traditional fossil fuels.

After calcination during the preheating step, the hot raw meal is put into the rotary kiln to melt at a temperature of around 1450˚C. At this step (liquid phase), the different oxides (lime, magnesium, aluminium, sulphur, iron, etc.) that made up the raw material recombine into a crystallographic structure different from the original one. The new material is then quickly cooled to achieve optimal crystal formation to produce clinker.

The clinker is grounded in a series of steel-bar rotary mills, and is mixed with the gypsum, limestone and other cementitious materials based on the recipe of the different cement products that Ciment Québec produces.

More details can be found on Ciment Québec's website: (https://cimentquebec.com/en/cement/production/)

2.3 PACKAGING

Cement can be delivered in bags, semi-bulk, or bulk. It can be transported by truck, train or boat.

2.4 TRANSPORTATION, USE CONDITIONS, PRODUCT SERVICE LIFE AND END-OF-LIFE

For this EPD, the system boundaries encompass a cradle-to-gate scope. The construction process stage (Module A4-A5), use stage (Module B1-B7) and end-of-life stage (Module C1-C4) are excluded from the study.

3 LCA CALCULATION RULES

3.1 DECLARED UNIT

The selected declared unit (DU) for this study is **1 metric tonne (MT) of cement**. A metric tonne is equivalent to 1,000 kg.

3.2 PRODUCTION AVERAGE

ELEMENT™ Blended Cements is a weighted average of GUb-SF and CompactCem™. They have slightly different amounts of additives (both below 1%). No other cements are averaged; they are all presented individually. It should be noted that the cements can be found under different names, but have the same composition.

3.3 SYSTEM BOUNDARIES

According to NSF International's PCR [1], the LCA modelling system boundaries are Cradle-to-Gate, i.e., only cover the production life cycle stage as illustrated in Table 3. Within this life cycle stage, three (3) modules are considered, namely A-1) Extraction and upstream production, A-2) Transport to facility and A-3) Manufacturing. Construction (A-4; A-5), use (B-1 to B-7) and end-of-life (C-1 to C-4) stages are not included in the present study. Figure 1 presents the process flow diagram for Ciment Québec's ELEMENT™ Portland, Portland-Limestone and Blended Portland cements.

Table 3: Description of the system boundary modules

PRODUCTION STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE			
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4
Extraction and Upstream Production	Transport to Facility	Manufacturing	Transport to Site	Installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational Energy Use	Operational Water Use	Deconstruction/ Demolition	Transport to waste processing or disposal	Waste Processing	Disposal
X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND

Legend: X = included; MND = module not declared (excluded)

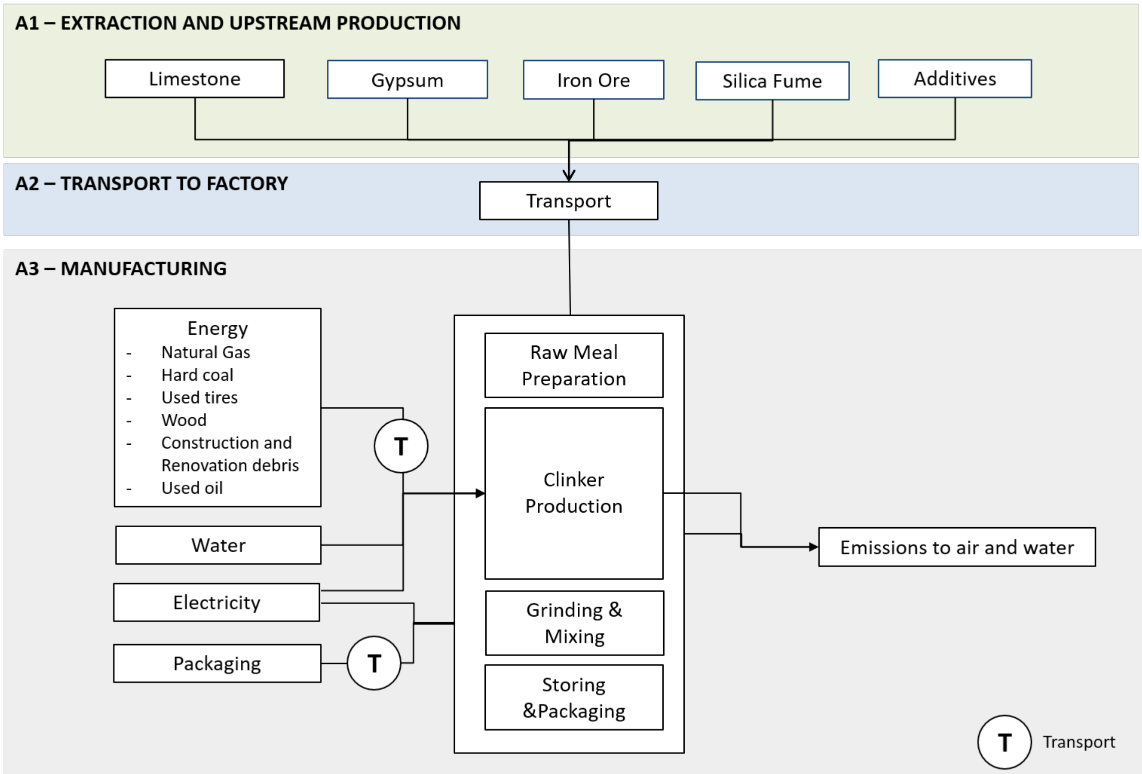

Figure 1: System boundaries of Cradle-to-Gate LCA (module A1 to A3) of Ciment Québec's ELEMENT™ Portland Cement, ELEMENT™ Portland-Limestone Cement and ELEMENT™ Blended Portland Cement produced in Saint-Basile (Quebec), Canada.

Extraction and upstream production: This module includes the extraction and transformation of raw materials included in the cements, such as limestone, gypsum, silica, iron ore, silica fume and additives.

Transport to facility: This module includes the transportation of raw materials from Ciment Québec's suppliers to Ciment Québec's facility.

Manufacturing: This module includes energy and water consumption for the manufacturing processes, which uses a dry kiln with a preheater and precalciner (limestone preparation, clinker, cement preparation). Emissions to air from fuel combustion as well as calcination have been considered. Used water is sent to the sediment basin prior to its release to nature.

Finally, packaging materials to make products ready for shipment, as well as their transport to Ciment Québec's manufacturing plant, are covered by this module.

3.4 CUT-OFF CRITERIA

According to the NSF International PCR [1], which follows ISO 21930:217 directives [2], cut-off rules shall not be applied in order to hide data. Any application of the criteria for the exclusion of inputs and outputs shall be documented.

In the present EPD, no primary data (input material, energy consumption) was excluded from the system boundaries.

For this study, no data on the construction, maintenance or dismantling of the capital assets, production equipment, daily transport of the employees, office work, business trips and other activity from Ciment Québec's employees was included in the model. The model only takes into account the processes associated with infrastructures that are already included in the *ecoinvent* unit processes.

3.5 CALCULATION METHOD

OpenLCA software v1.10.3 [4], an open source software, was used to calculate the inventory and to assess potential environmental impacts associated with the inventoried emissions.

3.6 ALLOCATION

Data relative to energy consumption (electricity and fuels), water consumption, emissions flows and packaging was provided for the whole manufacturing plant, except for carbon dioxide emissions. Whenever possible, allocation was avoided. When allocation could not be avoided, mass was used as the primary basis for co-product allocation [6].

According to Ciment Québec's process information, use of diesel and related carbon dioxide emissions are allocated to limestone production. Diesel is used in the heavy machinery at the limestone quarry and in transport trucks used to haul the limestone from the quarry to the cement plant. Energy, except electricity, and water use as well as related air and water emissions are allocated to clinker production. Electricity is used in various steps of the cement production process, and is attributed as follows: 9% to limestone quarry, 28% to clinker production and 63% to cement production [7]. Particulate emissions occur during different process steps and were allocated as follows: 91% to limestone quarry and preparation, 7% to clinker production and 2% for cement production [7]. Mass was used to allocate clinker and limestone inputs and outputs to the different cements.

It should be noted that, "*this subcategory PCR recognizes …, silica fume, …* [used oil, used tires, recovered wood, construction and demolition debris] *as recovered materials* [or secondary fuels] *and thus the environmental impacts allocated to these materials* [or secondary fuels] *are limited to the treatment and transportation required to use as a cement material* [or energy] *input.* [1]"

3.7 DATA SOURCES AND QUALITY REQUIREMENTS

Data Quality Parameter	Data Quality Discussion
Source of manufacturing data: Description sources of data	Manufacturing data was collected from Ciment Québec's manufacturing plant located in Saint-Basile (Quebec) for the 2019 production year. This data included: total annual mass of products produced at the manufacturing plant; specific cement composition; raw materials and fuels entering the product production process; transport distance of materials and fuels, electricity consumption, water consumption, emissions to the environment at the manufacturing plant, and packaging. Fuel energy content (LHV) were provided by Ciment Québec.
Source of secondary data: Description sources of raw materials, fuels and electricity data	**Coal**: ecoinvent 3.7 (2020) - hard coal mine operation and hard coal preparation | Cutoff, U - RNA-modified with commercial LHV of 28.83 MJ/kg **Diesel** used in limestone extraction and transport: ecoinvent 3.7 (2020) - diesel, burned in building machine | Cutoff, U - GLO modified to use specific CO_2, CH_4 and N_2O emissions values **Electricity**: ecoinvent 3.7 (2020) - market for electricity, medium voltage | Cutoff, U - CA-QC (93.4% hydro, 4.7% wind, 1.1% nuclear, 0.8% other) **Gypsum**: ecoinvent 3.7 (2020) - gypsum quarry operation | Cutoff, U – RoW **Iron**: ecoinvent 3.7 (2020)- iron mine operation and iron ore beneficiation to 65% Fe | Cutoff, U - CA-QC **Silica**: ecoinvent 3.7 (2020) - silica sand production | silica sand | Cutoff, U - RoW **Limestone**: Specific manufacturing data **Natural gas**: ecoinvent 3.7 (2020) - market for natural gas, high pressure | Cutoff, U - CA-QC
Geographical representativeness	Ciment Québec's manufacturing facility is based in the province of Quebec; hence electricity consumption is based on the Quebec grid mix and natural gas consumption from the Quebec supply. Geographical correlation of the material supply and the selected datasets are, in majority, representative of the same area. When this was not possible, datasets that represent a larger geographical area were used.
Temporal representativeness	Primary data was collected so as to be representative of the full 2019 year. Datasets selected were not always published within the last ten years. Nevertheless, ecoinvent and US LCI remain the reference LCI databases [8], [9].
Technological representativeness	Primary data, obtained from the manufacturer, is representative of the current technologies and materials used by this company.
Completeness	All relevant process steps were considered and modeled to satisfy the goal and scope. No known flows were cut off.

4 LIFE CYCLE ASSESSMENT RESULTS

Life cycle assessment results are presented for 1 metric tonne (MT) of cement. 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.

Environmental indicator		Unit	ELEMENT™ - Portland Cement			ELEMENT™ - Portland-Limestone Cement	ELEMENT™ - Blended Portland Cement
			GU Type I MS Type I/II Type II ProBase™ RehabSol™	HE Type III	GU-PER	GUL / IL	GUb-SF / CompactCem™
			(per 1 MT)	(per 1 MT)	(per 1 MT)	(per 1 MT)	(per 1MT)
TRACI 2.1							
GWP(1)	Global warming potential based on IPCC 2007 (AR4)	kg CO_2 eq.	7.28E+02	7.23E+02	7.07E+02	6.43E+02	6.60E+02
GWP(1)	Global warming potential based on IPCC 2013 (AR5)	kg CO_2 eq.	7.31E+02	7.25E+02	7.10E+02	6.45E+02	6.63E+02
ODP	Ozone depletion potential	kg CFC-11 eq.	4.82E-05	4.80E-05	4.70E-05	4.27E-05	4.36E-05
AP	Acidification potential	kg SO_2 eq.	2.68E+00	2.67E+00	2.62E+00	2.38E+00	2.47E+00
EP	Eutrophication potential	kg N eq.	3.43E-01	3.41E-01	3.35E-01	3.05E-01	3.15E-01
SFP	Smog formation potential	kg O_3 eq.	3.30E+01	3.30E+01	3.24E+01	2.95E+01	3.12E+01
ADP-f	Abiotic resource depletion potential - fossil fuels	MJ Surplus	3.24E+02	3.22E+02	3.16E+02	7.08E+01	3.04E+02
CML [v4.8 August 2016]							
ADP-e(2)	Abiotic resource depletion potential - elements*	kg Sb eq.	1.92E-05	1.95E-05	1.91E-05	1.78E-05	1.83E-05

* The following 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. Furthermore, not all LCA datasets for upstream materials include these impact categories and thus results may be incomplete..

(1): GWP, excludes biogenic CO_2 removals and emissions associated with biobased products and packaging; 100-year time horizon GWP factors are provided by the IPCC 2007 Fourth Assessment Report (AR4), default TRACI 2.1 GWP factors, and the IPCC 2013 Fifth Assessment Report (AR5).

(2): Characterization factors were added to this impact category based on the NSF International PCR for Concrete Table A4 [10].

Environmental indicator		Unit	ELEMENT™ - Portland Cement			ELEMENT™ - Portland-Limestone Cement	ELEMENT™ - Blended Portland Cement
			GU Type I MS Type I/II Type II ProBase™ RehabSol™	HE Type III	GU-PER	GUL / IL	GUb-SF / CompactCem™
			(per 1 MT)	(per 1 MT)	(per 1 MT)	(per 1 MT)	(per 1MT)
Carbon emissions and removals							
CCE(3)	Calcination carbon emissions	kg CO_2	4.74E+02	4.70E+02	4.59E+02	4.17E+02	4.25E+02
BCREP(4)	Biogenic CO2, reporting the removals and emissions associated with biogenic carbon content contained within biobased products	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

(3): Calculated based on Quebec's Ministry of the Environment and the Fight against Climate Change Guide to quantifying greenhouse gas emissions [4].

(4): CO_2 from biomass secondary fuels (recovered wood, renewable part of used tires and construction & demolition debris) used in the kiln are climate-neutral (CO_2 removal is equal to CO_2 emissions), ISO 21930:2017, 7.2.7.

GU Type I cements and cements falling under the same group, biogenic CO_2 = 0 (- 7.94E+1 kg CO_2eq./+7.94E+1 kg CO_2eq.).

HE Type III cements, biogenic CO_2 = 0 (- 7.87E+1 kg CO_2eq./+7.87E+1 kg CO_2eq.).

GU PER cements, biogenic CO_2 = 0 (- 7.70E+1 kg CO_2eq./+7.70E+1 kg CO_2eq.).

GUL/IL, cements, biogenic CO_2 = 0 (- 6.64E+1 kg CO_2eq./+6.64E+1 kg CO_2eq.).

Environmental indicator		Unit	ELEMENT™ - Portland Cement			ELEMENT™ - Portland-Limestone Cement	ELEMENT™ - Blended Portland Cement
			GU Type I MS Type I/II Type II ProBase™ RehabSol™	HE Type III	GU-PER	GUL / IL	GUb-SF / CompactCem™
			(per 1 MT)	(per 1 MT)	(per 1 MT)	(per 1 MT)	(per 1MT)
Resource use							
RPR_E(5)	Renewable primary resources as energy (fuel)*	MJ, LHV	1.48E+03	1.47E+03	1.47E+03	1.36E+03	1.37E+03
RPR_M(6)	Renewable primary resources as material*	MJ, LHV	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
$NRPR_E$(7)	Non-renewable primary resources as energy (fuel)*	MJ, LHV	3.33E+03	3.31E+03	3.25E+03	2.96E+03	3.09E+03
$NRPR_M$(6)	Non-renewable primary resources as material*	MJ, LHV	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SM(8)	Secondary materials*	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.00E+01
RSF(9)	Renewable secondary fuels*	MJ, LHV	8.45E+02	8.38E+02	8.19E+02	7.44E+02	7.58E+02
NRSF(10)	Non-renewable secondary fuels*	MJ, LHV	3.80E+02	3.76E+02	3.68E+02	3.34E+02	3.41E+02
FW(11)	Use of net fresh water resources	m³	1.76E+00	1.75E+00	1.71E+00	1.56E+00	1.59E+00

* The following 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. Furthermore, not all LCA datasets for upstream materials include these impact categories and thus results may be incomplete.

(5): $RPR_E = RPR_T - RPR_M$, where RPR_T is equal to the value for renewable energy obtained using the CED LHV methodology.

(6) Cements do not contain renewable or non-renewable primary resources with energy content used as material.

(7): $NRPR_E = NRPR_T - NRPR_M$, where $NRPR_T$ is equal to the value for non- renewable energy obtained using the CED LHV methodology.

(8): Calculated as per ACLCA ISO 21930 Guidance [11], 6.5 Secondary materials, SM: includes silica fume.

(9) Calculated as per ACLCA ISO 21930 Guidance [11], 6.6 Renewable secondary fuels, RSF: includes recovered wood, renewable part of used tires and construction & demolition debris.

(10): Calculated as per ACLCA ISO 21930 Guidance [11], 6.7 Non-renewable secondary fuels, NRSF: includes used oil, non-renewable part of used tires and construction & demolition debris.

(11): Use of water, excluding sea water and water for cooling in upstream processes.

Environmental indicator		Unit	ELEMENT™ - Portland Cement			ELEMENT™ - Portland-Limestone Cement	ELEMENT™ - Blended Portland Cement
			GU Type I MS Type I/II Type II ProBase™ RehabSol™	HE Type III	GU-PER	GUL / IL	GUb-SF / CompactCem™
			(per 1 MT)	(per 1 MT)	(per 1 MT)	(per 1 MT)	(per 1MT)
Output flows and waste categories							
HWD(12)	Hazardous waste disposed*	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NHWD(13)	Non-hazardous waste disposed*	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
HLRW(14)	High-level radioactive waste, conditioned, to final repository*	m^3	5.12E-09	5.32E-09	5.37E-09	4.88E-09	4.90E-09
ILLRW(15)	Intermediate- and low-level radioactive waste, conditioned to final repository*	m^3	2.23E-09	2.32E-09	2.34E-09	2.13E-09	2.13E-09
CRU	Components for re-use*	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MFR	Materials for recycling*	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MER	Materials for energy recovery*	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EE	Exported energy*	MJ, LHV	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Clinker		90.3%	89.5%	87.5%	75.5%	81.0%

* The following 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. Furthermore, not all LCA datasets for upstream materials include these impact categories and thus results may be incomplete.

(12): Calculated as per ACLCA ISO 21930 Guidance [11], 10.1 Hazardous waste disposed. Calculated based on 2019 primary data for hazardous waste disposed based solely on the foreground system (limestone extraction, clinker and cement production). N/A. Dust removed is reused in the cement production process.

(13): Calculated as per ACLCA ISO 21930 Guidance [11], 10.2 Non-hazardous waste disposed. Calculated based on 2019 primary data for non-hazardous waste disposed based solely on the foreground system (limestone extraction, clinker and cement production). N/A. Dust removed is reused in the cement production process.

(14): Calculated as per ACLCA ISO 21930 Guidance [11], 10.3 High-level radioactive waste, conditioned, to final repository. It should be noted that the cement foreground system (limestone extraction, clinker and cement production) does not generate any HLRW (high-level radioactive waste), e.g., when generated by electricity production, consists mostly of spent fuel from reactors. (ISO 21930:2017, clause 7.2.14).

(15): Calculated as per ACLCA ISO 21930 Guidance [11], 10.4 Intermediate- and low-level radioactive waste, conditioned, to final repository. It should be noted that the cement foreground system (limestone extraction, clinker and cement production) does not generate any ILLRW (low- and intermediate-level radioactive wastes), e.g., when generated by electricity production, arise mainly from routine facility maintenance and operations (ISO 21930:2017, clause 7.2.14).

5 ADDITIONAL ENVIRONMENTAL INFORMATION

5.1 REGULATED HAZARDOUS SUBSTANCES

Some cement substances are considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Table 4: Hazardous substances in cement as per product Safety Data Sheet

Ingredient name	CAS number	Present in
Aluminium dicalcium iron pentaoxide	12068-35-8	All cements
Dialuminium tricacium hexaoxide	12042-78-3	All cements
Calcium oxide	1305-78-8	ELEMENT™ Blended Portland Cement
Crystalline silica, respirable powder	14808-60-7	ELEMENT™ Blended Portland Cement

5.2 RELEASE OF DANGEROUS SUBSTANCES FROM CEMENT

Care should be taken when handling and storing cements as cement can cause serious eye damage/eye irritation (category 1) or skin corrosion/irritation (category 2). The likely routes of exposure are dermal contact, eye contact, inhalation or ingestion. Only calcium oxide and crystalline silica have known toxicological information. Refer to the product SDS for details (https://cimentquebec.com/en/cement/product-line/portland-cement/).

5.3 VALIDATED ECO-DECLARATION® AND HEALTH PRODUCT DECLARATION®

In addition, Ciment Québec is part of a third-party verification process with Vertima Inc. where Ciment Québec's products and its entire supply chain are assessed. At the end of the process, they received a Validated Eco-Declaration® summarizing verified environmental claims.

Ciment Québec also published a Health Product Declaration® for ELEMENT™ Portland Cement ELEMENT™ Portland-Limestone Cement and ELEMENT™ Blended Portland Cement. More details are available on the HPDC public repository: https://www.hpd-collaborative.org/hpd-public-repository/.

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