Environmental Product Declaration

ASTM INTERNATIONAL

A cradle-to-gate EPD according to ISO 14025 and ISO 21930

Normal weight and Lightweight Concrete Block Masonry Units as Manufactured by Members of the Canadian Concrete Masonry Producers Association (CCMPA)

CCMPA

About The CCMPA

For five decades, the CCMPA has worked on behalf of concrete masonry producers to build an industry as strong and as enduring as the products it manufactures. As a Canada-wide body with national membership, we're making our industry stronger.

Today, technology and innovation are presenting our industry with great opportunities and considerable challenges. As CCMPA, we will provide the inclusive representation and strong voice necessary to ensure that we meet those challenges, and that our products remain the building material of choice.

ASTM International Certified EPD

This is a Canadian industry-average business-to-business Type III environmental product declaration (EPD) for concrete block masonry units (CMU) as manufactured by Canadian Concrete Masonry Producers Association (CCMPA) members. This declaration has been prepared in accordance with ISO 14025 and ISO 21930, and the UL product category rules (PCR) and ASTM General Program Instructions.

The intent of this document is to further the development of environmentally compatible and more sustainable construction products by providing comprehensive environmental information related to potential impacts of block CMU manufactured in Canada in accordance with international standards.

Program Operator

ASTM International
Environmental Product Declarations
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General Program Instructions v.2.5 March 2020

Owner of the EPD

Canadian Concrete Masonry Producers Association (CCMPA)
PO Box 1492
Waterdown, ON
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www.ccmpa.ca

CCMPA Member-company Corporate Address & Facility Locations Applicable to this EPD

Groupe MBM
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Piedmont, Québec
J0R 1K0
www.groupembm.com

locations: Piedmont, Québec

Brampton Brick Limited
225 Wanless Drive
Brampton, Ontario
L7A 1E9
www.bramptonbrick.com

locations: Brampton, ON; Brockville, ON; Cambridge, ON

Doughty Concrete Products Ltd.
1555 Chemong Road
Peterborough, Ontario
K9J 6X2
www.doughtymasonry.ca

locations: Peterborough, Ontario

Canal Block
3562 Nugent Road
Port Colborne, Ontario
L3K 5V5
www.canalblock.com

locations: Port Colborne, Ontario

Casey Concrete Ltd 96 Park Street Amherst, Nova Scotia B4H 2M8 www.caseyltd.ca **locations:** Amherst, Nova Scotia	**Century Concrete Products Ltd 2016** 4170 Midland Ave Scarborough, Ontario M1V 4S6 www.centuryconcrete.ca **locations:** Scarborough, Ontario
Day & Campbell Limited 1074 Upper Wellington Street Hamilton, Ontario L9A 3S6 www.daycampbell.com **locations:** Hamilton, Ontario	**Cindercrete Products Ltd.** P.O. Box 306 Hwy #1 East Regina, Saskatchewan S4P 3A1 www.cindercrete.com **locations:** Regina, Saskatchewan
Concrete Products 260 East White Hills Road P.O. Box 8056 STN 'A' St. John's, Newfoundland A1B 3M7 www.newcrete.ca **locations:** St. John's, Newfoundland	**Expocrete, an Oldcastle company** #38, 53016 HWY 60 Acheson, Alberta T7X 5A7 www.expocrete.com **locations:** Acheson & Edmonton, Alberta; Winnipeg, Manitoba
Rainbow Concrete Industries Ltd. 2477 Maley Drrive Sudbury, Ontario P3A 4R7 www.rcil.ca **locations:** Sudbury, Ontario	**Niagara Block Inc.** 5000 Montrose Road Niagara Falls, Ontario L2H 1K5 www.niagarablock.com **locations:** Niagara Falls, Ontario
Shaw Brick 1 Shaw Dr P.O. Box 2130 Lantz, Nova Scotia B2S 3G4 www.shawbrick.com **locations:** Fredericton, New Brunswick; Lantz, Nova Scotia	

EPD Information

Product Names
Normal weight & lightweight concrete block masonry unit (CMU)

Product Definition
Manufactured masonry unit made of concrete in which the binder is a combination of water and cementitious materials

Declared Unit
1 m^3 of concrete formed into manufactured concrete masonry product (CMU)

Declaration Number
EPD- 338

Declaration Type
A "cradle-to-gate" EPD for normal weight and lightweight concrete block masonry units manufactured by CCMPA members across Canada. Activity stages or information modules covered include production (modules A1 to A3). The declaration is intended for use in Business-to-Business (B-to-B) communication. This EPD of concrete block masonry units (UN CPC 3755) is an average product EPD, as an average from several CCMPA manufacturers' facilities as listed under "CCMPA Member-company Corporate Address & Facility Locations Applicable to this EPD" – see pg. 2.

Content of the Declaration
The declaration follows UL PCR Part B: Concrete Masonry and Segmental Concrete Paving Product EPD Requirements, V1.0, November 2020.

Declaration Comparability Limitation Statement
Environmental declarations from different programs (ISO 14025) may not be comparable. EPDs are comparable only if they use the same PCR (or sub-category PCR where applicable), include all relevant information modules and are based on equivalent scenarios with respect to the context of construction works. This PCR allows EPD comparability only when the same functional requirements between products are ensured and the requirements of ISO 21930:2017 §5.5 are met. However, variations and deviations are possible. Example of variations: different LCA software and background LCI datasets may lead to different results for the life cycle stages declared.

Applicable Countries	Date of Issue	Period of Validity
Canada	September 6, 2022	5 years

EPD Prepared by

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Verification
This EPD was independently verified by ASTM in accordance with ISO 14025:

Internal	External
	X

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EPD Type	Industry Average
Dataset Variability	Industry Average

EPD Scope	Cradle-to-gate
Year(s) of Manufacturer Reported Data	2020
LCA Software and Version Number	Athena Concrete LCA Calculator V2
LCI Database(s) and Version Number	SimaPro 8.5, USLCI 2019
LCIA Methodology and Version Number	TRACI 2.1
PCR Information	
Reference PCR	UL PCR Part B: Concrete Masonry and Segmental Concrete Paving Product EPD Requirements, V1.0,
Date of Issue	November 11, 2020
PCR review was conducted by:	Jack Geibig Ecoform, LLC Terrie Boguski Harmony Environmental, LLC Christine A. Subasic, P.E., LEED AP

1. PRODUCT IDENTIFICATION

This EPD reports industry-average environmental information for products broadly called either a "normal weight" or "lightweight" concrete block masonry unit, produced by CCMPA members at their facilities located across Canada. See Figure 1 for a visual representation of a commonly used stretcher block CMU.

Figure 1: Concrete Block Masonry Unit

Block CMUs are used in loadbearing and non-loadbearing (such as partition wall and infill wall) wall construction. The blocks are laid in horizontal rows; successive rows are bonded by mortar beds and optionally reinforced with steel reinforcing and/or concrete grout placed vertically and/or horizontally. Block CMUs are also used in masonry columns and beam construction.

The applicable Canadian product standard for block CMUs (UN CPC 3755) is ***CSA A165.1-14 - Concrete block masonry units.***

Block CMUs typically have a length of 390 mm, a height of 190 mm, and a thickness of either 90 mm, 140 mm, 190 mm, 240 mm, or 290 mm[1].

[1] The noted thicknesses are the "basic or manufactured" thicknesses in accordance with CSA A165.1, which correspond to "nominal or modular" thicknesses of 10, 15, 20, 25 and 30, respectively, stated in centimetres.

Table 1 below summarizes the specifications for concrete block masonry units that are applicable to this EPD, in accordance with the CSA A165.1-14 "Four Facet" system.

Table 1: Concrete Block Masonry Unit Products Applicable to this EPD

Facet	Specification Identification		Comments
	Normal weight CMU	Lightweight CMU	
First: Identifies the solid content of the block.	H, S, or SF		The symbols H, S, and Sc indicate, respectively, less than 75%, greater than 75% but less than 100%, and 100% solid content.
Second: Identifies the minimum compressive strength of the block CMU based on its average net cross-sectional area, in MPa.	15	15	The strength of the units is a statistically reduced value based on average compressive strength and standard deviation using test results of five CMU specimens.
Third: identifies concrete types based on stated ranges of CMU oven-dry concrete density and the maximum water absorption permitted for each density, given in kg/m^3.	A	C	A and C refer to concrete types for CMUs with oven dry densities of >2,000 and 1,700-1,800 kg/m^3 respectively, having maximum water absorption requirements of 175 and 225 kg/m^3, respectively.
Fourth: identifies the maximum moisture content of the unit at the time of delivery, expressed as a percentage of total absorption, determined by the shrinkage characteristics of the unit and the Relative Humidity of service environment.	M, O		"M" identifies a unit that satisfies the moisture content limit of the fourth facet; "O" identifies a unit that has no limit placed on its moisture content at time of delivery.

2. DECLARED UNIT

The declared unit is 1 m^3 of concrete formed into manufactured concrete masonry product (CMU).

3. REFERENCE SERVICE LIFE

The reference service life of block CMU is dependent on its end-use and its service environment which can vary dramatically and therefore is not declared herein. Per the PCR, we recommend a default reference service life of 75 years for concrete masonry products.

4. MATERIAL CONTENT

Table 2 below presents the industry-average material content by input material for the two block CMU products (normal weight and lightweight), as derived by the CCMPA and Athena.

Table 2: Material Properties of Block CMU Products

Inputs	Normal Weight Block CMU Ingredients	Lightweight Block CMU Ingredients
Density (kg/m³)	2186.12	1722.56
Minimum Compressive Strength (MPa) per CSA 165.1	15	15
Cement (% of total mass)		
Portland Cement/Portland Limestone Cement	8.73%	9.16%
Aggregate (% of total mass)		
Crushed Coarse Aggregate	18.05%	4.71%
Natural Coarse Aggregate	1.49%	3.81%
Crushed Fine Aggregate	14.13%	0.00%
Natural Fine Aggregate	56.70%	11.04%
Pelletized Slag	0.00%	6.19%
Expanded Slag	0.00%	47.51%
Natural Lightweight Aggregate	0.00%	14.44%
SCMs (% of total mass)		
Slag Cement (GGBFS)	0.45%	1.29%
Fly Ash	0.45%	1.85%
Admixtures (% of total mass)		
Air Entrainer	0.00%	0.00%
Water Reducer	0.01%	0.00%

5. SYSTEM BOUNDARY

As per the UL PCR, the system boundary is the product stage, which includes the following modules:

A1 Raw material supply;
A2 Transport (to the manufacturer); and
A3 Manufacturing.

Figure 2 shows the production stage system boundary for block CMU.

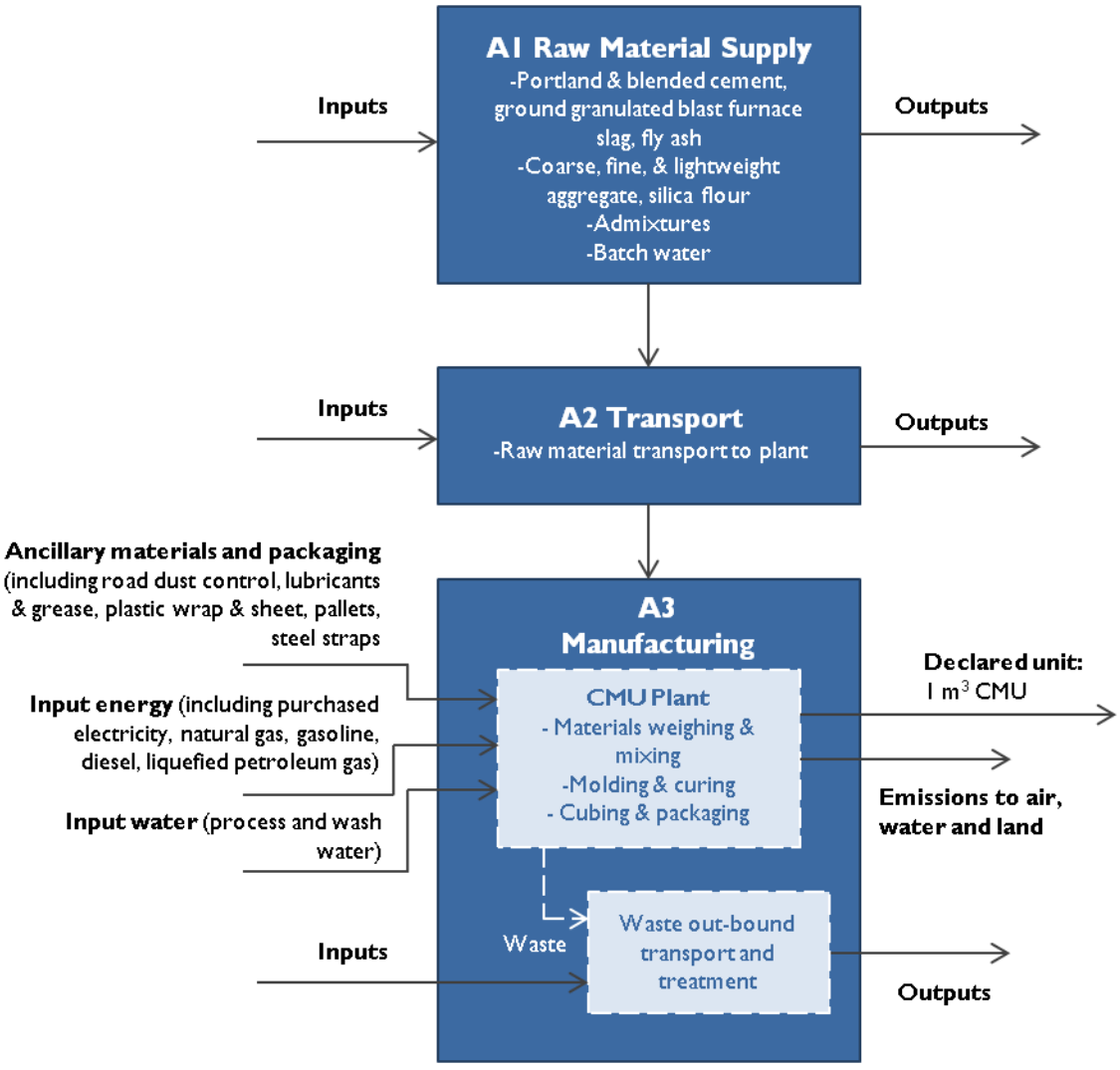

Figure 2: Product Stage (module A1 to A3) System Boundary

6. LIFE CYCLE INVENTORY

Primary LCI Data

Primary data is based on 18 surveys of block CMU facilities deemed representative of CCMPA member-companies, taking into consideration regional production, and plant size and type.

The following primary data was obtained from CCMPA member-companies, for the 2020 calendar year:

- Block CMU and other product production amounts, and average concrete batch waste;
- Inbound transportation distances and modes for raw materials, and ancillary and packaging materials;
- Facility electricity and fuel consumption, and process and wash water use;
- Ancillary and packaging material use;
- Process air emissions;
- Waste outputs and outbound transportation distances and modes.

In instances where plant data were missing for a particular parameter of interest, that plant's data were removed from the horizontal averaging for that parameter.

Secondary LCI Data

See Table 3-5 for a summary of secondary LCI data sources used to complete a production stage LCA model for the two block CMU products.

Table 3: Secondary LCI Data Sources Summary – Module A1

Materials	LCI Data Source	Year / Region	Data Quality Assessment
GU and GUL Cement *ASTM C150, C595, C1157*	Calculated based on EPD data for specific suppliers	2021-2022 Canada	• Technology: very good • Time: very good • Geography: very good • Completeness: very good • Reliability: very good
Fly Ash *ASTM C618*	None, no incoming burden, only transport is considered	N/A	• N/A • Recovered material

Materials	LCI Data Source	Year / Region	Data Quality Assessment
Silica Fume *ASTM c1240*	None, no incoming burden, only transport is considered	N/A	• N/A • Recovered material
Slag Cement *ASTM C989*	Slag Cement Association EPD of North America Slag Cement (2021)	2021 North America	• Technology: very good • Time: very good • Geography: very good • Completeness: very good • Reliability: very good
Crushed Aggregates *coarse and fine* *ASTM C33*	ecoinvent 3.4: "Gravel, crushed {RoW}| production | Cut-off, U" (2018) Modified foreground process with region-specific electricity grid.	2001 World/ Regional	• Technology: very good • Time: poor • Geography: good • Completeness: very good • Reliability: very good
Natural Aggregates *coarse and fine* *ASTM C330*	ecoinvent 3.4: "Gravel, round {RoW}| gravel and sand quarry operation | Cut-off, U" (2018) Modified foreground process with region-specific electricity grid.	2001 World/ Regional	• Technology: very good • Time: poor • Geography: good • Completeness: very good • Reliability: very good
Admixtures *ASTM C494*	EFCA EPDs for Air Entrainers, Plasticisers and superplasticisers, Hardening Accelerators, Set Accelerators, Water Resisting Admixtures, and Retarders (2015)	2015 EU	• Technology: very good • Time: very good • Geography: fair • Completeness: good • Reliability: very good

Materials	LCI Data Source	Year / Region	Data Quality Assessment
Batch and Wash Water *ASTM C1602*	ecoinvent 3.4: Tap water {RoW}| market for | Cut-off, U (2018) Modified foreground process with Canada average electricity grid	2011 World/ USA	• Technology: very good • Time: good • Geography: good • Completeness: very good • Reliability: very good

Table 4: Secondary LCI Data Sources Summary – Module A2

Process	LCI Data Source	Year / Region	Data Quality Assessment
Road	USLCI 2014: Transport, combination truck, short-haul, diesel powered/tkm/RNA (2014)	2010 USA	• Technology: very good • Time: good • Geography: very good • Completeness: very good • Reliability: very good
Rail	USLCI 2014: Transport, train, diesel powered /US U (2014)	2007 USA	• Technology: very good • Time: fair • Geography: very good • Completeness: very good • Reliability: very good
Ocean	USLCI 2014: Transport, ocean freighter, average fuel mix /US U (2014)	2007 USA	• Technology: very good • Time: fair • Geography: very good • Completeness: very good • Reliability: very good
Barge	USLCI 2014: Transport, barge, average fuel mix /US U (2014)	2007 USA	• Technology: very good • Time: fair • Geography: very good • Completeness: very good • Reliability: very good

Table 5: Secondary LCI Data Sources Summary – Module A3

Process	LCI Data Source	Year / Region	Data Quality Assessment
Electricity	ecoinvent 3.4: Electricity, low voltage | market for | Cut-off, U (2018) Modeled with provincial-specific electricity grids	2015 USA	• Technology: very good • Time: very good • Geography: very good • Completeness: very good Reliability: very good
Natural Gas	USLCI 2014: Natural Gas, combusted in industrial boiler /US U (2014)	2007 USA	• Technology: very good • Time: fair • Geography: very good • Completeness: very good • Reliability: very good
Diesel	USLCI 2014: Diesel, combusted in industrial equipment /US U (2014)	2007 USA	• Technology: very good • Time: fair • Geography: very good • Completeness: very good Reliability: very good
Gasoline	USLCI 2014: Gasoline, combusted in equipment /US U (2014)	2007 USA	• Technology: very good • Time: fair • Geography: very good • Completeness: very good • Reliability: very good
Liquefied Propane Gas	USLCI 2014: Liquefied petroleum gas, combusted in industrial boiler /US U (2014)	2007 USA	• Technology: very good • Time: fair • Geography: very good • Completeness: very good • Reliability: very good
Hazardous Solid Waste,	ecoinvent 3.4: Hazardous waste, for incineration {RoW}| treatment of hazardous waste, hazardous waste incineration | Alloc Rec, U (2018)	2011 World/ USA	• Technology: very good • Time: good • Geography: good • Completeness: very good • Reliability: very good
Non-Hazardous Solid Waste	ecoinvent 3.4: Inert waste {RoW}| treatment of, sanitary landfill | Alloc Rec, U (2018)	2011 World/ USA	• Technology: very good • Time: good • Geography: good • Completeness: very good • Reliability: very good

Cut-off and Allocation

All input/output flow data reported by the facility were included in the LCI modelling. Allocation procedures observed the requirements and guidance of ISO 14044:2006, clause 4.3. and those specified in UL PCR. Block CMU plant LCI environmental flows (inputs and outputs) were allocated to the two products (normal weight and lightweight CMU blocks) on a per-m^3 basis.

Data Quality

Data quality requirements, as specified in UL PCR: 2020, were observed. This section describes the achieved data quality relative to the ISO 14044:2006 requirements.

Precision: CCMPA members, through measurement and calculation, collected primary data on their production of block CMU. For accuracy the plant gate-to-gate data were individually validated.

Completeness: All relevant, specific processes, including inputs (raw materials, energy, and ancillary and packaging materials) and outputs (emissions and production volume) were considered.

Reproducibility: Internal reproducibility is possible since the data and the models are stored and available in Athena's LCA Software. A high level of transparency is provided throughout the report as the LCI profile is presented for the declared product.

Representativeness: The representativeness of the data is summarized as follows:

- Time related coverage: *primary* collected data for the block CMU manufacturing process: 2020; all *secondary* data has been validated.
- Geographical coverage: the geographical coverage is Canada.
- Technological coverage: typical or average.

7. LIFE CYCLE ASSESSMENT

This section summarizes the results of the life cycle impact assessment (LCIA) based on the cradle-to-gate life cycle inventory inputs and outputs analysis.

7.1 A1-A3 RESULTS

As per the UL PCR, Section 8, US EPA Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts (TRACI, version 2.1) impact categories are used as they provide a North American context for the mandatory category indicators to be included in this EPD. Tables 6-9 present the results for the normal weight and lightweight blocks in the two regions with the baseline assumption that GU cement is used. Tables 7-13 present the results for the same products comprised of GUL cement as opposed to GU cement.

7.1.1 A1-A3 Results – GU Cement

Table 6: East Region Block CMU Results, Lightweight CMU GU SCM, per m^3

Impact category and inventory indicators	Unit	Module A1	Module A2	Module A3	Total A1-A3
Environmental impacts					
GWP	kg CO_2 eq.	138.67	14.85	23.03	176.54
ODP	kg CFC-11 eq.	6.42E-04	6.27E-10	7.87E-07	6.43E-04
EP	kg N eq.	0.09	0.01	0.03	0.13
AP	kg SO_2 eq.	0.48	0.17	0.36	1.01
POCP	kg O_3 eq.	6.29	4.39	1.76	12.44
Use of primary resources					
RPRE	MJ, NCV	31.64	0.00	59.73	91.38
RPRM	MJ, NCV	0.00	0.00	0.00	0.00
NRPRE	MJ, NCV	557.86	225.85	998.12	1781.83
NRPRM	MJ, NCV	0.00	0.00	0.00	0.00
Use of secondary resources					
SM	kg	0.00	0.00	0.00	0.00
RSF	MJ, NCV	0.00	0.00	0.00	0.00
NRSF	MJ, NCV	1350.83	0.00	0.33	1351.17
RE	MJ, NCV	0.00	0.00	0.00	0.00
Abiotic depletion potential					
ADPf	MJ, LHV	61.73	213.06	668.96	943.75
ADPe	kg Sb	4.65E-05	0.00E+00	2.07E-05	6.71E-05
Consumption of freshwater resources					
FW	m^3	0.45	0.00	1.89	2.34
Waste and output flows					
HWD	kg	0.01	0.00	0.00	0.01
NHWD	kg	156.97	0.00	0.31	157.28
HLRW	m^3	5.27E-08	0.00E+00	1.26E-09	5.40E-08
ILLRW	m^3	1.85E-07	0.00E+00	1.10E-08	1.96E-07
CRU	kg	0.00	0.00	0.00	0.00
MR	kg	0.00	0.00	0.00	0.00
MER	kg	0.00	0.00	0.00	0.00
EE	kg	0.00	0.00	0.00	0.00
Additional inventory parameters for transparency					
GWPCALC	kg CO_2 eq.	61.56	0.00	0.00	61.56
GWPCARB	kg CO_2 eq.	0.00	0.00	-21.00	-21.00

Table 7: West Region Block CMU Results, Lightweight CMU GU SCM, per m^3

Impact category and inventory indicators	Unit	Module A1	Module A2	Module A3	Total A1-A3
Environmental impacts					
GWP	kg CO_2 eq.	151.52	14.86	47.56	213.94
ODP	kg CFC-11 eq.	4.61E-06	6.27E-10	1.22E-06	5.83E-06
EP	kg N eq.	0.21	0.01	0.44	0.66
AP	kg SO_2 eq.	0.37	0.17	0.44	0.98
POCP	kg O_3 eq.	7.11	4.39	2.62	14.12
Use of primary resources					
RPRE	MJ, NCV	8.33	0.00	24.29	32.62
RPRM	MJ, NCV	0.00	0.00	0.00	0.00
NRPRE	MJ, NCV	773.23	226.02	1005.82	2005.07
NRPRM	MJ, NCV	0.00	0.00	0.00	0.00
Use of secondary resources					
SM	kg	0.00	0.00	0.00	0.00
RSF	MJ, NCV	0.00	0.00	0.00	0.00
NRSF	MJ, NCV	91.36	0.00	0.16	91.52
RE	MJ, NCV	0.00	0.00	0.00	0.00
Abiotic depletion potential					
ADPf	MJ, LHV	179.86	213.22	902.49	1295.57
ADPe	kg Sb	4.77E-05	0.00E+00	2.12E-05	6.89E-05
Consumption of freshwater resources					
FW	m^3	0.37	0.00	1.89	2.26
Waste and output flows					
HWD	kg	0.01	0.00	0.00	0.01
NHWD	kg	42.97	0.00	0.31	43.28
HLRW	m^3	8.46E-09	0.00E+00	1.26E-09	9.73E-09
ILLRW	m^3	1.54E-07	0.00E+00	1.10E-08	1.65E-07
CRU	kg	0.00	0.00	0.00	0.00
MR	kg	0.00	0.00	0.00	0.00
MER	kg	0.00	0.00	0.00	0.00
EE	kg	0.00	0.00	0.00	0.00
Additional inventory parameters for transparency					
GWPCALC	kg CO_2 eq.	75.34	0.00	0.00	75.34
GWPCARB	kg CO_2 eq.	0.00	0.00	-21.00	-21.00

Table 8: East Region Block CMU Results, Normal Weight CMU GU SCM, per m^3

Impact category and inventory indicators	Unit	Module A1	Module A2	Module A3	Total A1-A3
Environmental impacts					
GWP	kg CO_2 eq.	168.74	13.62	23.03	205.38
ODP	kg CFC-11 eq.	7.77E-04	5.75E-10	7.87E-07	7.78E-04
EP	kg N eq.	0.12	0.01	0.03	0.16
AP	kg SO_2 eq.	0.58	0.16	0.36	1.10
POCP	kg O_3 eq.	7.52	4.02	1.76	13.30
Use of primary resources					
RPRE	MJ, NCV	49.59	0.00	59.73	109.32
RPRM	MJ, NCV	0.00	0.00	0.00	0.00
NRPRE	MJ, NCV	740.03	207.10	998.12	1945.25
NRPRM	MJ, NCV	0.00	0.00	0.00	0.00
Use of secondary resources					
SM	kg	0.00	0.00	0.00	0.00
RSF	MJ, NCV	0.00	0.00	0.00	0.00
NRSF	MJ, NCV	8557.56	0.00	0.33	8557.89
RE	MJ, NCV	0.00	0.00	0.00	0.00
Abiotic depletion potential					
ADPf	MJ, LHV	139.13	195.37	668.96	1003.46
ADPe	kg Sb	1.40E-04	0.00E+00	2.07E-05	1.60E-04
Consumption of freshwater resources					
FW	m^3	0.56	0.00	1.89	2.45
Waste and output flows					
HWD	kg	0.00	0.00	0.00	0.00
NHWD	kg	189.86	0.00	0.31	190.17
HLRW	m^3	3.06E-07	0.00E+00	1.26E-09	3.07E-07
ILLRW	m^3	3.59E-07	0.00E+00	1.10E-08	3.70E-07
CRU	kg	0.00	0.00	0.00	0.00
MR	kg	0.00	0.00	0.00	0.00
MER	kg	0.00	0.00	0.00	0.00
EE	kg	0.00	0.00	0.00	0.00
Additional inventory parameters for transparency					
GWPCALC	kg CO_2 eq.	74.46	0.00	0.00	74.46
GWPCARB	kg CO_2 eq.	0.00	0.00	-21.00	-21.00

Table 9: West Region Block CMU Results, Normal Weight CMU GU SCM, per m^3

Impact category and inventory indicators	Unit	Module A1	Module A2	Module A3	Total A1-A3
Environmental impacts					
GWP	kg CO_2 eq.	190.45	13.63	47.56	251.64
ODP	kg CFC-11 eq.	5.65E-06	5.75E-10	1.22E-06	6.87E-06
EP	kg N eq.	0.36	0.01	0.44	0.81
AP	kg SO_2 eq.	0.47	0.16	0.44	1.07
POCP	kg O_3 eq.	8.72	4.03	2.62	15.37
Use of primary resources					
RPRE	MJ, NCV	13.20	0.00	24.29	37.49
RPRM	MJ, NCV	0.00	0.00	0.00	0.00
NRPRE	MJ, NCV	1006.18	207.30	1005.82	2219.30
NRPRM	MJ, NCV	0.00	0.00	0.00	0.00
Use of secondary resources					
SM	kg	0.00	0.00	0.00	0.00
RSF	MJ, NCV	0.00	0.00	0.00	0.00
NRSF	MJ, NCV	88.19	0.00	0.16	88.35
RE	MJ, NCV	0.00	0.00	0.00	0.00
Abiotic depletion potential					
ADPf	MJ, LHV	342.78	195.56	902.49	1440.83
ADPe	kg Sb	1.46E-04	0.00E+00	2.12E-05	1.68E-04
Consumption of freshwater resources					
FW	m^3	0.41	0.00	1.89	2.30
Waste and output flows					
HWD	kg	0.00	0.00	0.00	0.00
NHWD	kg	51.97	0.00	0.31	52.28
HLRW	m^3	1.61E-09	0.00E+00	1.26E-09	2.87E-09
ILLRW	m^3	1.45E-07	0.00E+00	1.10E-08	1.56E-07
CRU	kg	0.00	0.00	0.00	0.00
MR	kg	0.00	0.00	0.00	0.00
MER	kg	0.00	0.00	0.00	0.00
EE	kg	0.00	0.00	0.00	0.00
Additional inventory parameters for transparency					
GWPCALC	kg CO_2 eq.	91.13	0.00	0.00	91.13
GWPCARB	kg CO_2 eq.	0.00	0.00	-21.00	-21.00

7.1.1 A1-A3 Results - GUL cement

Table 10: East Region Block CMU Results, Lightweight CMU GUL SCM, per m^3

Impact category and inventory indicators	Unit	Module A1	Module A2	Module A3	Total A1-A3
Environmental impacts					
GWP	kg CO_2 eq.	128.24	12.90	23.03	164.16
ODP	kg CFC-11 eq.	4.55E-06	5.45E-10	7.87E-07	5.34E-06
EP	kg N eq.	0.09	0.01	0.03	0.13
AP	kg SO_2 eq.	0.52	0.15	0.36	1.03
POCP	kg O_3 eq.	7.73	3.81	1.76	13.30
Use of primary resources					
RPRE	MJ, NCV	40.06	0.00	59.73	99.79
RPRM	MJ, NCV	0.00	0.00	0.00	0.00
NRPRE	MJ, NCV	545.08	196.20	998.12	1739.40
NRPRM	MJ, NCV	0.00	0.00	0.00	0.00
Use of secondary resources					
SM	kg	0.00	0.00	0.00	0.00
RSF	MJ, NCV	0.00	0.00	0.00	0.00
NRSF	MJ, NCV	1348.97	0.00	0.33	1349.30
RE	MJ, NCV	0.00	0.00	0.00	0.00
Abiotic depletion potential					
ADPf	MJ, LHV	64.75	185.09	668.96	918.80
ADPe	kg Sb	4.70E-05	0.00E+00	2.07E-05	6.77E-05
Consumption of freshwater resources					
FW	m^3	0.48	0.00	1.89	2.37
Waste and output flows					
HWD	kg	0.01	0.00	0.00	0.01
NHWD	kg	204.95	0.00	0.31	205.26
HLRW	m^3	5.27E-08	0.00E+00	1.26E-09	5.40E-08
ILLRW	m^3	1.85E-07	0.00E+00	1.10E-08	1.96E-07
CRU	kg	0.00	0.00	0.00	0.00
MR	kg	0.00	0.00	0.00	0.00
MER	kg	0.00	0.00	0.00	0.00
EE	kg	0.00	0.00	0.00	0.00
Additional inventory parameters for transparency					
GWPCALC	kg CO_2 eq.	69.03	0.00	0.00	69.03
GWPCARB	kg CO_2 eq.	0.00	0.00	-21.00	-21.00

Table 11: West Region Block CMU Results, Lightweight CMU GUL SCM, per m^3

Impact category and inventory indicators	Unit	Module A1	Module A2	Module A3	Total A1-A3
Environmental impacts					
GWP	kg CO_2 eq.	137.45	12.91	47.56	197.93
ODP	kg CFC-11 eq.	4.66E-06	5.45E-10	1.22E-06	5.88E-06
EP	kg N eq.	0.20	0.01	0.44	0.65
AP	kg SO_2 eq.	0.34	0.15	0.44	0.93
POCP	kg O_3 eq.	6.44	3.81	2.62	12.88
Use of primary resources					
RPRE	MJ, NCV	25.82	0.00	24.29	50.11
RPRM	MJ, NCV	0.00	0.00	0.00	0.00
NRPRE	MJ, NCV	731.25	196.40	1005.82	1933.47
NRPRM	MJ, NCV	0.00	0.00	0.00	0.00
Use of secondary resources					
SM	kg	0.00	0.00	0.00	0.00
RSF	MJ, NCV	0.00	0.00	0.00	0.00
NRSF	MJ, NCV	84.35	0.00	0.16	84.51
RE	MJ, NCV	0.00	0.00	0.00	0.00
Abiotic depletion potential					
ADPf	MJ, LHV	161.07	185.28	902.49	1248.84
ADPe	kg Sb	4.71E-05	0.00E+00	2.12E-05	6.83E-05
Consumption of freshwater resources					
FW	m^3	0.36	0.00	1.89	2.25
Waste and output flows					
HWD	kg	0.01	0.00	0.00	0.01
NHWD	kg	38.80	0.00	0.31	39.11
HLRW	m^3	8.46E-09	0.00E+00	1.26E-09	9.73E-09
ILLRW	m^3	1.54E-07	0.00E+00	1.10E-08	1.65E-07
CRU	kg	0.00	0.00	0.00	0.00
MR	kg	0.00	0.00	0.00	0.00
MER	kg	0.00	0.00	0.00	0.00
EE	kg	0.00	0.00	0.00	0.00
Additional inventory parameters for transparency					
GWPCALC	kg CO_2 eq.	66.69	0.00	0.00	66.69
GWPCARB	kg CO_2 eq.	0.00	0.00	-21.00	-21.00

Table 12: East Region Block CMU Results, Normal Weight CMU GUL SCM, per m^3

Impact category and inventory indicators	Unit	Module A1	Module A2	Module A3	Total A1-A3
Environmental impacts					
GWP	kg CO_2 eq.	156.29	11.26	23.03	190.58
ODP	kg CFC-11 eq.	5.47E-06	4.75E-10	7.87E-07	6.26E-06
EP	kg N eq.	0.12	0.01	0.03	0.16
AP	kg SO_2 eq.	0.63	0.13	0.36	1.12
POCP	kg O_3 eq.	9.26	3.33	1.76	14.34
Use of primary resources					
RPRE	MJ, NCV	60.25	0.00	59.73	119.98
RPRM	MJ, NCV	0.00	0.00	0.00	0.00
NRPRE	MJ, NCV	728.30	171.31	998.12	1897.74
NRPRM	MJ, NCV	0.00	0.00	0.00	0.00
Use of secondary resources					
SM	kg	0.00	0.00	0.00	0.00
RSF	MJ, NCV	0.00	0.00	0.00	0.00
NRSF	MJ, NCV	8555.30	0.00	0.33	8555.64
RE	MJ, NCV	0.00	0.00	0.00	0.00
Abiotic depletion potential					
ADPf	MJ, LHV	146.28	161.61	668.96	976.85
ADPe	kg Sb	1.45E-04	0.00E+00	2.07E-05	1.66E-04
Consumption of freshwater resources					
FW	m^3	0.59	0.00	1.89	2.48
Waste and output flows					
HWD	kg	0.00	0.00	0.00	0.00
NHWD	kg	247.90	0.00	0.31	248.20
HLRW	m^3	3.06E-07	0.00E+00	1.26E-09	3.07E-07
ILLRW	m^3	3.59E-07	0.00E+00	1.10E-08	3.70E-07
CRU	kg	0.00	0.00	0.00	0.00
MR	kg	0.00	0.00	0.00	0.00
MER	kg	0.00	0.00	0.00	0.00
EE	kg	0.00	0.00	0.00	0.00
Additional inventory parameters for transparency					
GWPCALC	kg CO_2 eq.	83.50	0.00	0.00	83.50
GWPCARB	kg CO_2 eq.	0.00	0.00	-21.00	-21.00

Table 13: West Region Block CMU Results, Normal Weight CMU GUL SCM, per m^3

Impact category and inventory indicators	Unit	Module A1	Module A2	Module A3	Total A1-A3
Environmental impacts					
GWP	kg CO_2 eq.	173.45	11.27	47.56	232.28
ODP	kg CFC-11 eq.	5.71E-06	4.76E-10	1.22E-06	6.93E-06
EP	kg N eq.	0.35	0.01	0.44	0.79
AP	kg SO_2 eq.	0.43	0.13	0.44	1.01
POCP	kg O_3 eq.	7.91	3.33	2.62	13.87
Use of primary resources					
RPRE	MJ, NCV	34.36	0.00	24.29	58.65
RPRM	MJ, NCV	0.00	0.00	0.00	0.00
NRPRE	MJ, NCV	955.43	171.48	1005.82	2132.73
NRPRM	MJ, NCV	0.00	0.00	0.00	0.00
Use of secondary resources					
SM	kg	0.00	0.00	0.00	0.00
RSF	MJ, NCV	0.00	0.00	0.00	0.00
NRSF	MJ, NCV	79.72	0.00	0.16	79.88
RE	MJ, NCV	0.00	0.00	0.00	0.00
Abiotic depletion potential					
ADPf	MJ, LHV	320.06	161.77	902.49	1384.32
ADPe	kg Sb	1.46E-04	0.00E+00	2.12E-05	1.67E-04
Consumption of freshwater resources					
FW	m^3	0.40	0.00	1.89	2.30
Waste and output flows					
HWD	kg	0.00	0.00	0.00	0.00
NHWD	kg	46.93	0.00	0.31	47.24
HLRW	m^3	1.61E-09	0.00E+00	1.26E-09	2.87E-09
ILLRW	m^3	1.45E-07	0.00E+00	1.10E-08	1.56E-07
CRU	kg	0.00	0.00	0.00	0.00
MR	kg	0.00	0.00	0.00	0.00
MER	kg	0.00	0.00	0.00	0.00
EE	kg	0.00	0.00	0.00	0.00
Additional inventory parameters for transparency					
GWPCALC	kg CO_2 eq.	80.66	0.00	0.00	80.66
GWPCARB	kg CO_2 eq.	0.00	0.00	-21.00	-21.00

7.2 Interpretation

The results confirm our understanding of the concrete impacts. Overall, upstream materials production (A1) accounts for the largest proportion of the GWP (69% to 82%). The raw materials production is also a significant contributor to non-renewable energy use (31%-45%) while the facility operations cause the greatest proportion of impacts in both regions (45%-57%). The variation within each grouping is due to variations to the concrete mixes and differences such as electricity grids.

This EPD was calculated using manufacturer specific cement data that represents 100% of the total cement used in this mix. 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.

8. REFERENCES

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