Brampton Brick Ltd.
CarboClave Block
Environmental Product Declaration

According to ISO 14025:2006 and ISO 21930:2017

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An Environmental Product Declaration

In accordance with ISO 14025 and 21930:2017

About this EPD

This is a Type III environmental product declaration (EPD) for CarboClave concrete block as produced by Brampton Brick Ltd. (Brampton Brick) at its facility located in Cambridge, Ontario. The results of the underlying LCA are computed using SimaPro version 10.2.0.1 (1).

This EPD is certified by ASTM to conform to UL Environment Part A: Life Cycle Assessment Calculation Rules and Report Requirements (2), UL Environment Part B: Concrete Masonry and Segmental Concrete Paving Product EPD Requirements (3), as well as to the requirements of ISO 14025 (4), ISO 21930:2017 (5), and ASTM International's General Program Instructions (6). This EPD is intended for business-to-business audiences.

General Summary

EPD Commissioner and Owner	Brampton Brick Ltd. 225 Wanless Drive Brampton, Ontario. L7A 1E9 https://bramptonbrick.com Brampton Brick company personnel provided both LCI and meta data for CarboClave block manufacturing for the 2023 reference year in support of this EPD. *The owner of the declaration is liable for the underlying information and evidence*.
Product Group and Name	*Concrete Block Masonry Unit* UNSPCS: 30131502 CSI MasterFormat Division: 04 22 00
Product Definition	***Concrete masonry units (CMUs)***, commonly known as concrete blocks, cinder blocks, or breeze blocks, are rectangular precast concrete blocks used in building construction. Similar to other precast products, they are manufactured using cement, sand, and aggregate. Brampton Brick's CarboClave concrete blocks utilize recovered carbon dioxide as a curing agent in lieu of typical steam curing. Molded blocks are loaded into an autoclave and pressurized with CO_2. The CO_2 causes the carbonation reaction to occur, which produces calcium carbonate crystals ($CaCO_3$) in the concrete.
Date of Issue & Validity Period	April 21, 2026 – valid for 5 years
Declared Unit	One cubic meter (m^3) of concrete formed into manufactured concrete products.
LCA Software	SimaPro version 10.2.0.1
LCI Databases	USLCI 2024 Q3 ecoinvent 3.11, Allocation, cut-off by classification
LCIA Methodologies	IPCC AR5, TRACI 2.1, CML-baseline v4.7

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EPD and Project Report Information

Program Operator	ASTM International
Declaration Number	EPD 1170
Declaration Type	Cradle-to-gate (modules A1 to A3). Facility and product-specific.
Applicable Countries	Canada and US
Product Applicability	*Concrete masonry blocks* are versatile building materials used across a wide range of applications, from structural foundations and load-bearing walls to non-load bearing architectural cladding and partition systems. Their strength, durability, and fire resistance make them suitable for residential, commercial, and industrial construction. With a variety of sizes, finishes, and reinforcement options available, concrete masonry blocks can be tailored to meet both structural performance requirements and architectural design goals.
Content of the Declaration	The EPD follows Section 1, Content of the EPD, as documented in UL Part B PCR (3).
This EPD was independently verified by ASTM in accordance with ISO 14025 and the reference PCR: Internal: – External: X	Tim Brooke ASTM International 100 Barr Harbor Drive PO Box C700 West Conshohocken PA 19428-2959, USA cert@astm.org Thomas P. Gloria, Ph. D. Industrial Ecology Consultants 35 Bracebridge Road Newton, MA 02459-1728
EPD Prepared by:	Athena Sustainable Materials Institute 280 Albert Street, Suite 404 Ottawa, Ontario, Canada K1P 5G8 info@athenasmi.org www.athenasmi.org

PCR Information

Program Operator	UL Environment
Reference PCR	UL Environment Part A: Life Cycle Assessment Calculation Rules and Report Requirements (2) UL Environment Part B: Concrete Masonry and Segmental Concrete Paving Product EPD Requirements (3)
PCR review was conducted by:	Part A PCR: Lindita Bushi, PhD (Chair) Hugues Imbeault-Tétreault, Eng., M.A.Sc. Jack Geibig Part B PCR: Jack Geibig Terrie Boguski Christine A. Subasic P.E., LEED AP

Company Description

With its roots dating back to 1871, Brampton Brick Ltd. has evolved to become a leading North American manufacturer of masonry and hardscape products for the construction and renovation industry. The Brampton, Ontario facility sells directly to leading builders and developers, as well as through a North American dealer network. The company has separated itself from the competition by combining its immense clay brick experience with concrete expertise to establish itself as the ONE Trusted Source for masonry brick, stone, block and concrete hardscape products.

Product Description

CarboClave CMU blocks (UNSPCS 30131502, CSI MasterFormat Division 04 22 00) utilize recovered carbon dioxide as a curing agent in lieu of typical steam curing. Molded blocks are loaded into the autoclave and pressurized with CO_2. The CO_2 causes the carbonation reaction to occur, which produces calcium carbonate crystals ($CaCO_3$) in the concrete. As the CO_2 is consumed, the pressure in the autoclave reduces to 0 psi and the process is repeated multiple times until the blocks are fully cured. Since converting operations from autoclave steam curing to CarboClave, the facility has eliminated their use of energy for curing and now sequester a minimum of 0.5 lbs (0.227 kg) of CO_2 into each 20cm block produced.

Some of the observed characteristics of CarboClave CMU blocks are:

- High compressive strength;
- Better freeze thaw resistance;
- Improved sulphate attack resistance;
- Greater resistance to drying and atmospheric shrinkage;
- Reduced sorptivity/permeability;
- Reduced efflorescence effect; and
- Consistent colour in production.

This LCA covers four separate concrete mixes used in the manufacture of CarboClave CMU blocks, as follows:

- Normal weight, standard strength
- Normal weight, high strength
- Light weight, standard strength
- Light weight, high strength

Figure 1 below illustrates typical CarboClave CMU blocks as manufactured by Brampton Brick.

Figure 1: Brampton Brick's CarboClave CMU Block.

Products and Standards

The applicable North American standards for CarboClave CMU blocks are as follows:

- CSA A165 series, CSA Standards on Concrete Masonry Units
- CSA A371 – Masonry Construction for Buildings
- ASTM C55 – Standard Specification for Concrete Building Brick
- ASTM C90 – Standard Specification for Loadbearing Concrete Masonry Units
- ASTM C1634 – Standard Specification for Concrete Facing Brick and Other Masonry Facing Units

CSA A165.1 (7) defines the facet design system for specifying concrete masonry units. The four facet designation system provides a methodology for users to define specific properties of their CMU block required for a particular application. The four facets include solid content, specified compressive strength, concrete type, and moisture content.

Table 1 below provides further details on the facet designation system.

Table 1: CSA A165.1 Facet System

Facet	Symbol	Property		
First		Solid content		
	H	Hollow		
	SS	Semi-solid		
	SF	Full solid		
Second		Minimum specified compressive strength calculated on average net cross-sectional area of the unit, MPa		
	10	10		
	15	15		
	20	20		
	30	30		
Third		Concrete type		
		Density, kg/m^3	Absorption (maximum), kg/m^3	
	A	Over 2000	175	
	B	1800 - 2000	200	
	C	1700 – 1800	225	
	D	Less than 1700	300	
	N	No limits	No limits	
Fourth		Maximum moisture content, % of total absorption (average of 5 specimens)		
		Linear shrinkage, %	Moisture content	
			RH over 75%	RH under 75%
	M	Less than 0.03	45	40
		0.03-0.045	40	35
		Over 0.045	35	30
	0	No limits	No limits	

The four declared product categories covered in this EPD are defined by the Facet System as noted in Table 2 below.

Table 2: Declared products and Their Facet Designation

	Declared Product			
Facet	Normal weight, standard strength	Normal weight, high strength	Light weight, standard strength	Light weight, high strength
Solids Content	H, SS, & SF	H, SS, & SF	H, SS, & SF	H, SS, & SF
Specified Compression Strength	20	30	15	20
Concrete Type	A	A	C	C
Moisture Content	M & O	M & O	M & O	M & O

The percent composition of the four declared products are outlined in Table 3 below.

Table 3: Material Composition of declared products

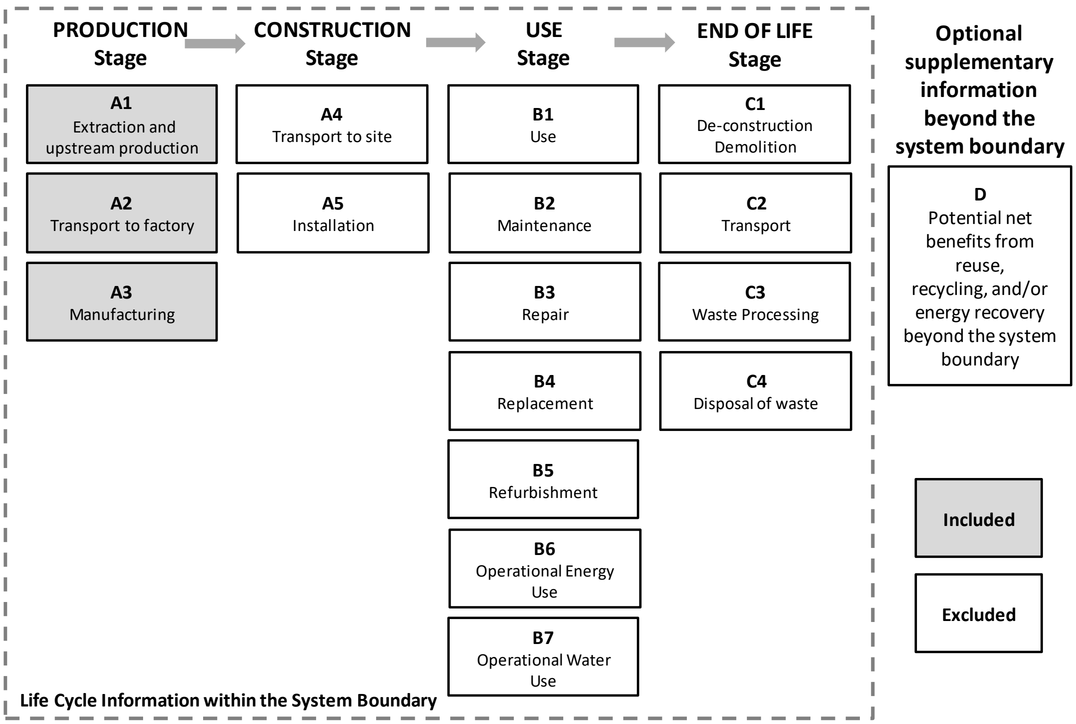
Material	Normal weight, standard strength	Normal weight, high strength	Light weight, standard strength	Light weight, high strength
Portland-limestone cement (GUL),	8.2%	13.3%	11.6%	15.3%
Slag cement (GGBFS)	1.5%	0.0%	1.9%	0.0%
Crushed coarse aggregate	19.2%	18.4%	0.0%	0.0%
Natural fine aggregate	67.6%	63.5%	19.0%	13.5%
Expanded slag	0.0%	0.0%	62.4%	66.3%
Water reducing admixture	0.0%	0.0%	0.0%	0.0%
Carbon dioxide	1.5%	1.4%	1.4%	1.4%
Batch water	2.1%	3.3%	3.6%	3.4%

Declared Unit

The declared unit is one cubic meter (m^3) of concrete formed into manufactured concrete products.

System Boundary

This is a cradle-to-gate EPD covering the production stage (A1-A3) as depicted in the figure below. The production stage includes extraction and upstream production of raw materials (cradle) through the manufacture and transport of CMU block ready for shipment (gate).



The production stage includes the following processes:

A1 Extraction and Upstream Production: Extraction, manufacturing, and processing of input materials.

A2 Transportation to Factory: Transportation of all input materials from the suppliers to the gate of the manufacturing facility.

A3 Manufacturing: The preparation processes of Brampton Brick's manufacturing facility. This phase also includes the injection of CO_2 as a curing agent into the autoclave, and subsequent carbonation CO_2 removals.

Items *excluded* from the system boundary include:

- Production, manufacture, and construction of manufacturing capital goods and infrastructure;
- Production and manufacture of production equipment, delivery vehicles, and laboratory equipment;
- Personnel related activities (travel, office operations and 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.

Cut-off Criteria

The cut-off criteria for all activity stage flows considered within the system boundary conform with ISO 14044:2006 (8) and UL Part A PCR Section 2.9 (2). Specifically, the cut-off criteria were applied as follows:

- All inputs and outputs for which data is available is included in the calculated effects. No collected core process data is excluded.
- A one-percent cut-off is considered for renewable and non-renewable primary energy consumption and the total mass of inputs within a unit process. The sum of the total neglected flows does not exceed 5% of all energy consumption and mass of inputs.
- All flows known to contribute a significant impact or to uncertainty are included.
- The cut-off rules are not applied to hazardous and toxic material flows – all of which are included in the life cycle flow inventory.

Cut-off rules were applied to several additives as no applicable secondary datasets were available. Each individual flow was less than 1% of the cumulative mass of the system model, the cumulative mass of the flows was below 5% of the cumulative mass of the system model, and none of the flows are expected to significantly contribute to the environmental impact of the product system.

Data Collection

Life cycle inventory data and production meta data for CarboClave block manufacturing was collected from Brampton Brick for the 2023 reference year. For accuracy, the LCA team individually validated these gate-to-gate input and output data.

Allocation Rules

As specified in UL Part B PCR Section 3.5 (2), mass should be used as the primary basis for co-product allocation. Data has been provided by Brampton Brick specifically for the CarboClave CMU block manufacture, and as such, no allocation to co-products has been required in the completion of the study.

Allocation between declared products has been used in the completion of the study for product-generic flows, such as facility energy usage, material handling energy usage, packaging material inputs, and waste outputs. Given the declared unit for this study is *one m^3 of concrete formed into manufactured concrete products*, these product-generic flows have been allocated to each declared product on a volume basis as opposed to mass basis as . Generally, facility energy use, packaging, and waste generation are primarily drive by production volume rather than product density. For example, autoclave curing is conducted in fixed-volume chambers, with loads managed by volume, independent of block density. Facility electricity and energy usage also scale with plant throughput in m^3 rather than product weight. Given the difference in mass between the declared product, using mass as the basis of allocation for these inputs will inherently over-represent the environmental impacts associated with normal-weight products, while under-representing the light-weight products.

As specified in UL PCR Part B Section 3.7 (3), this EPD recognizes fly ash, silica fume, and slag as recovered materials and thus the environmental impacts allocated to these materials are limited to the treatment processes and transportation required for their use as concrete material inputs.

Data Quality Requirements and Assessment

Data Quality Requirements	Description
Technology Coverage	Data represents the prevailing technology in use in Brampton Brick's facility. Whenever available, for all upstream and core material and processes, North American typical or average industry LCI datasets were utilized.
Geographic Coverage	The geographic region considered is North America. Whenever available, for all upstream and core material and processes, geographically specific LCI datasets were utilized. Geographical representativeness is characterized as "high".
Time Coverage	Activity data are representative as of 2023. CarboClave CMU block manufacturing: primary data collected from the Cambridge manufacturing facility for the 2023 fiscal year (November 2022 to October 2023); Generic data: the most appropriate LCI datasets were used as found in the US LCI Database, ecoinvent v.3.11 database for North America and global, 2025. Temporal representativeness is characterized as "high".
Completeness	All relevant, specific processes, including inputs (raw materials, energy and ancillary materials) and outputs (emissions and production volume) were considered and modeled. The relevant background materials and processes were taken from the US LCI Database, ecoinvent v 3.11 LCI database for US, and/or North America, and modeled in SimaPro software v.10.2.0.1, 2025. The completeness of the cradle-to-gate process chains in terms of process steps is rigorously assessed in the project background report.
Consistency	To ensure consistency, the same modelling structure has been used to model the four declared products. Crosschecks concerning the plausibility of mass and energy flows were continuously conducted. The LCA team conducted mass and energy balances at the facility level and selected process levels to maintain a high level of consistency.
Reproducibility	Internal reproducibility is possible since the data and the models are stored and available in Brampton Brick CarboClave Athena LCI database developed in SimaPro, 2025. External reproducibility is not possible as the source LCI data and subsequent LCA background report are confidential.
Transparency	Activity and background LCI datasets are transparently documented in the LCA report, including data sources.
Uncertainty	A sensitivity check was conducted to assess the reliability of the EPD results and conclusions by determining how they are affected by uncertainties in the data or assumptions on calculation of LCIA and energy indicator results. The results of the sensitivity analysis are documented in the project report.

Life Cycle Impact Assessment Results: Brampton Brick CarboClave CMU Blocks

This section summarizes the production stage life cycle impact assessment (LCIA) results including resource use and waste generated metrics based on the cradle-to-gate life cycle inventory inputs and outputs analysis. The results are calculated based on one meter cubed (m^3) of concrete formed into manufactured concrete products as manufactured by Brampton Brick with impact categories and inventory metrics specified in the UL Part A PCR (2).

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 (8), (9). Further, 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 (*)

Limitations on comparability

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.

As documented in UL Part A PCR (2), only the five TRACI indicators and ADP_f (GWP-100, AP, EP, SFP, ODP, ADP_f) are globally deemed mature enough to be included in Type III environmental declarations. Other categories are being developed and defined and LCA should continue making advances in their development. However, the EPD user shall not use additional measures for comparative purposes.

Table 3: Normal-weight, standard strength production stage EPD results per m^3 of concrete formed into manufactured concrete products

Impact category and inventory indicators	Unit	A1 Extraction & Upstream Production	A2 Transport to Factory	A3 Manufacturing	A1-A3 Total
Global warming potential, 100-year, GWP-100[1) 2)]	kg CO_2 eq	148	6.37	-11.0	143
Acidification potential, AP[1)]	kg SO_2 eq	0.18	4.78E-02	7.17E-02	0.30
Eutrophication potential, EP[1)]	kg N eq	5.08E-02	2.99E-03	7.14E-02	0.13
Smog formation potential, SFP[1)]	kg O_3 eq	2.91	1.67	2.36	6.94
Ozone depletion potential, ODP[1)]	kg CFC-11 eq	6.62E-06	2.67E-08	9.97E-08	6.74E-06
Abiotic depletion potential for non-fossil mineral resources, ADP_e[3)*]	kg Sb eq	0.33	2.00E-08	3.00E-06	0.33
Abiotic depletion potential for fossil resources, ADP_f[3)]	MJ, LHV	626	1.93	56.0	684
Renewable primary resources used as an energy carrier (fuel), RPR_{e*}	MJ, LHV	58.7	4.19E-04	192	251
Renewable primary resources with energy content used as material, RPR_m[4)*]	MJ, LHV	-	-	-	-
Non-renewable primary resources used as an energy carrier (fuel), $NRPR_{e*}$	MJ, LHV	737	1.93	429	1168
Non-renewable primary resources with energy content used as material, $NRPR_m$[4)*]	MJ, LHV	-	-	-	-
Secondary material, SM[4)*]	kg	57.5	0	0	57.5
Renewable secondary fuel, RSF[4)*]	MJ, LHV	-	-	-	-
Non-renewable secondary fuel, NRSF[4)*]	MJ, LHV	-	-	-	-
Recovered energy, RE[4)*]	MJ, LHV	-	-	-	-
Consumption of fresh water, FW[5)]	m^3	0.32	0	4.62E-02	0.37
Hazardous waste disposed, HWD[4)*]	kg	2.35E-02	0	9.67E-02	0.12
Non-hazardous waste disposed, NHWD[4)*]	kg	1.02	0	15.5	16.5
High-level radioactive waste, conditioned, to final repository HLRW[6)*]	kg	2.41E-03	0	4.75E-03	7.16E-03
Intermediate and low level radioactive waste, conditioned, to final repository, ILLRW[7)*]	kg	1.66E-03	0	1.58E-03	3.24E-03
Components for re-use, CRU[4)*]	kg	-	-	-	-
Materials for recycling, MR[4)*]	kg	4.38E-02	0	48.2	48.2
Materials for energy recovery, MER[4)*]	kg	-	-	-	-
Exported energy, EE[4)*]	MJ, LHV	-	-	-	-
Calcination carbon emissions, CCE	kg CO_2	73.0	0	0	73.0
Carbonation carbon removals, CCR[8)]	kg CO_2	0	0	31.6	31.6
Biogenic carbon removals from packaging, BCRK	kg CO_2	0	0	15.4	15.4
Biogenic carbon emissions from packaging, BCEK	kg CO_2	0	0	15.4	15.4

Table 4: Normal-weight, high strength production stage EPD results per m^3 of concrete formed into manufactured concrete products

Impact category and inventory indicators	Unit	A1 Extraction & Upstream Production	A2 Transport to Factory	A3 Manufacturing	A1-A3 Total
Global warming potential, 100-year, GWP-100[1) 2)]	kg CO_2 eq	235	8.11	-11.3	231
Acidification potential, AP[1)]	kg SO_2 eq	0.16	6.08E-02	7.17E-02	0.29
Eutrophication potential, EP[1)]	kg N eq	5.62E-02	3.81E-03	7.14E-02	0.13
Smog formation potential, SFP[1)]	kg O_3 eq	2.22	2.12	2.36	6.70
Ozone depletion potential, ODP[1)]	kg CFC-11 eq	9.27E-06	3.40E-08	9.97E-08	9.40E-06
Abiotic depletion potential for non-fossil mineral resources, ADP_e[3)*]	kg Sb eq	0.00	2.55E-08	3.00E-06	0.00
Abiotic depletion potential for fossil resources, ADP_f[3)]	MJ, LHV	871	2.45	56.0	930
Renewable primary resources used as an energy carrier (fuel), RPR_{e*}	MJ, LHV	81.2	5.33E-04	192	273
Renewable primary resources with energy content used as material, RPR_m[4)*]	MJ, LHV	-	-	-	-
Non-renewable primary resources used as an energy carrier (fuel), $NRPR_{e*}$	MJ, LHV	980	2.45	429	1412
Non-renewable primary resources with energy content used as material, $NRPR_m$[4)*]	MJ, LHV	-	-	-	-
Secondary material, SM[4)*]	kg	42.9	0	0	42.9
Renewable secondary fuel, RSF[4)*]	MJ, LHV	-	-	-	-
Non-renewable secondary fuel, NRSF[4)*]	MJ, LHV	-	-	-	-
Recovered energy, RE[4)*]	MJ, LHV	-	-	-	-
Consumption of fresh water, FW[5)]	m^3	0.44	0	7.25E-02	0.52
Hazardous waste disposed, HWD[4)*]	kg	3.32E-02	0	9.67E-02	0.13
Non-hazardous waste disposed, NHWD[4)*]	kg	1.56	0	15.5	17.0
High-level radioactive waste, conditioned, to final repository HLRW[6)*]	kg	2.35E-03	0	4.75E-03	7.10E-03
Intermediate and low level radioactive waste, conditioned, to final repository, ILLRW[7)*]	kg	1.05E-03	0	1.58E-03	2.63E-03
Components for re-use, CRU[4)*]	kg	-	-	-	-
Materials for recycling, MR[4)*]	kg	6.52E-02	0	48.2	48.2
Materials for energy recovery, MER[4)*]	kg	-	-	-	-
Exported energy, EE[4)*]	MJ, LHV	-	-	-	-
Calcination carbon emissions, CCE	kg CO_2	122.0	0	0	122.0
Carbonation carbon removals, CCR[8)]	kg CO_2	0	0	31.9	31.9
Biogenic carbon removals from packaging, BCRK	kg CO_2	0	0	15.4	15.4
Biogenic carbon emissions from packaging, BCEK	kg CO_2	0	0	15.4	15.4

Table 5: Light-weight, standard strength production stage EPD results per m^3 of concrete formed into manufactured concrete products

Impact category and inventory indicators	Unit	A1 Extraction & Upstream Production	A2 Transport to Factory	A3 Manufacturing	A1-A3 Total
Global warming potential, 100-year, GWP-100[1) 2)]	kg CO_2 eq	167	19.29	-4.8	182
Acidification potential, AP[1)]	kg SO_2 eq	0.17	1.45E-01	7.17E-02	0.38
Eutrophication potential, EP[1)]	kg N eq	4.58E-02	9.06E-03	7.14E-02	0.13
Smog formation potential, SFP[1)]	kg O_3 eq	2.59	5.06	2.36	10.00
Ozone depletion potential, ODP[1)]	kg CFC-11 eq	7.22E-06	8.09E-08	9.97E-08	7.41E-06
Abiotic depletion potential for non-fossil mineral resources, ADP_e[3)*]	kg Sb eq	0.00	6.06E-08	3.00E-06	0.00
Abiotic depletion potential for fossil resources, ADP_f[3)]	MJ, LHV	650	5.84	56.0	711
Renewable primary resources used as an energy carrier (fuel), RPR_{e*}	MJ, LHV	57.7	1.27E-03	192	250
Renewable primary resources with energy content used as material, RPR_m[4)*]	MJ, LHV	-	-	-	-
Non-renewable primary resources used as an energy carrier (fuel), $NRPR_{e*}$	MJ, LHV	731	5.84	429	1166
Non-renewable primary resources with energy content used as material, $NRPR_m$[4)*]	MJ, LHV	-	-	-	-
Secondary material, SM[4)*]	kg	1168.2	0	0	1168.2
Renewable secondary fuel, RSF[4)*]	MJ, LHV	-	-	-	-
Non-renewable secondary fuel, NRSF[4)*]	MJ, LHV	-	-	-	-
Recovered energy, RE[4)*]	MJ, LHV	-	-	-	-
Consumption of fresh water, FW[5)]	m^3	0.24	0	6.47E-02	0.30
Hazardous waste disposed, HWD[4)*]	kg	2.81E-02	0	9.67E-02	0.12
Non-hazardous waste disposed, NHWD[4)*]	kg	1.38	0	15.5	16.9
High-level radioactive waste, conditioned, to final repository HLRW[6)*]	kg	1.24E-03	0	4.75E-03	5.99E-03
Intermediate and low level radioactive waste, conditioned, to final repository, ILLRW[7)*]	kg	1.36E-03	0	1.58E-03	2.94E-03
Components for re-use, CRU[4)*]	kg	-	-	-	-
Materials for recycling, MR[4)*]	kg	5.05E-02	0	48.2	48.2
Materials for energy recovery, MER[4)*]	kg	-	-	-	-
Exported energy, EE[4)*]	MJ, LHV	-	-	-	-
Calcination carbon emissions, CCE	kg CO_2	84.9	0	0	84.9
Carbonation carbon removals, CCR[8)]	kg CO_2	0	0	25.4	25.4
Biogenic carbon removals from packaging, BCRK	kg CO_2	0	0	15.4	15.4
Biogenic carbon emissions from packaging, BCEK	kg CO_2	0	0	15.4	15.4

Table 6: Light-weight, high strength production stage EPD results per m^3 of concrete formed into manufactured concrete products

Impact category and inventory indicators	Unit	A1 Extraction & Upstream Production	A2 Transport to Factory	A3 Manufacturing	A1-A3 Total
Global warming potential, 100-year, GWP-100[1) 2)]	kg CO_2 eq	213	20.86	-4.9	229
Acidification potential, AP[1)]	kg SO_2 eq	0.12	1.56E-01	7.17E-02	0.35
Eutrophication potential, EP[1)]	kg N eq	4.35E-02	9.80E-03	7.14E-02	0.12
Smog formation potential, SFP[1)]	kg O_3 eq	1.59	5.47	2.36	9.41
Ozone depletion potential, ODP[1)]	kg CFC-11 eq	8.30E-06	8.75E-08	9.97E-08	8.49E-06
Abiotic depletion potential for non-fossil mineral resources, ADP_e[3)*]	kg Sb eq	0.00	6.55E-08	3.00E-06	0.00
Abiotic depletion potential for fossil resources, ADP_f[3)]	MJ, LHV	749	6.31	56.0	811
Renewable primary resources used as an energy carrier (fuel), RPR_{e*}	MJ, LHV	69.3	1.37E-03	192	261
Renewable primary resources with energy content used as material, RPR_m[4)*]	MJ, LHV	-	-	-	-
Non-renewable primary resources used as an energy carrier (fuel), $NRPR_{e*}$	MJ, LHV	830	6.31	429	1266
Non-renewable primary resources with energy content used as material, $NRPR_m$[4)*]	MJ, LHV	-	-	-	-
Secondary material, SM[4)*]	kg	1214.6	0	0	1214.6
Renewable secondary fuel, RSF[4)*]	MJ, LHV	-	-	-	-
Non-renewable secondary fuel, NRSF[4)*]	MJ, LHV	-	-	-	-
Recovered energy, RE[4)*]	MJ, LHV	-	-	-	-
Consumption of fresh water, FW[5)]	m^3	0.30	0	6.02E-02	0.36
Hazardous waste disposed, HWD[4)*]	kg	3.26E-02	0	9.67E-02	0.13
Non-hazardous waste disposed, NHWD[4)*]	kg	1.30	0	15.5	16.8
High-level radioactive waste, conditioned, to final repository HLRW[6)*]	kg	1.16E-03	0	4.75E-03	5.91E-03
Intermediate and low level radioactive waste, conditioned, to final repository, ILLRW[7)*]	kg	7.25E-04	0	1.58E-03	2.31E-03
Components for re-use, CRU[4)*]	kg	-	-	-	-
Materials for recycling, MR[4)*]	kg	5.99E-02	0	48.2	48.2
Materials for energy recovery, MER[4)*]	kg	-	-	-	-
Exported energy, EE[4)*]	MJ, LHV	-	-	-	-
Calcination carbon emissions, CCE	kg CO_2	112.0	0	0	112.0
Carbonation carbon removals, CCR[8)]	kg CO_2	0	0	25.5	25.5
Biogenic carbon removals from packaging, BCRK	kg CO_2	0	0	15.4	15.4
Biogenic carbon emissions from packaging, BCEK	kg CO_2	0	0	15.4	15.4

Notes to Table 3 through Table 6:

1) Calculated as per U.S EPA TRACI 2.1, SimaPro v 10.2.0.1 (1)
2) 100-year time horizon GWP factors are provided by the IPCC 2013 Fifth Assessment Report (AR5).
3) Calculated as per CML-IA Baseline v4.7, SimaPro v 10.2.0.1 (1)
4) Calculated as per relevant ACLCA 21930 Guidance (10)
5) Calculated as per UL Part A PCR Section 4.1.1 (2). Net freshwater consumptions is reported as an LCI indicator and includes data from upstream EPDs, as well as foreground processes.
6) It should be noted that the foreground system (A3 manufacturing process) 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)
7) It should be noted that the foreground system (A3 manufacturing process) 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)
8) CO_2 sequestered from carbonation is calculated as the amount of CO_2 injected into the autoclave during the curing process, which is then carbonated in the CMU block. It does not account for natural carbonation from the atmosphere over the course of the CMU block's life cycle.

LCA Interpretation

The Extraction & Upstream Production (A1) module is the main contributor to the potential environmental impacts. The potential environmental impacts associated with Module A1 are predominantly driven by the upstream manufacturing of cement.

Additional Environmental Information

No additional environmental information is reported.

References

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3. UL Environment. Product Category Rules (PCR) Guidance for Building-Related Products and Services. Part B: Concrete Masonry and Segmental Concrete Paving Product EPD Requirements. UL Standard 10010-29. Version 1.1. March 1, 2022.

4. ISO 14025: 2006 Environmental labeling and declarations - Type III environmental declarations - Principles and procedures.

5. ISO 21930:2017 Sustainability in buildings and civil engineering works - Core rules for environmental product declarations of construction products and services.

6. ASTM Program Operator Rules. Version 8.0, Revised April 2020.

7. CSA A165.1-14 (R2024). Concrete Block Masonry Units.

8. ISO 14044/Amd1:2017/Amd2:2020 Environmental Management – Life Cycle Assessment – Requirements and guidelines.

9. ISO 14040:2006/Amd 1:2020 Environmental Management – Life Cycle Assessment – Principles and Framework.

10. ACLCA 2019, Guidance to Calculating Non-LCIA Inventory Metrics in Accordance with ISO 21930:2017. The American Centre for Life Cycle Assessment. May, 2019.