



Environmental Product Declaration

MOCTEZUMA®

Environmental Product Declaration for cement products
produced by Cementos Moctezuma, S.A. de C.V. at their
Apazapan facility in Veracruz, México

ADMINISTRATIVE INFORMATION

International Certified Environmental Product Declaration

Declared Product:	This Environmental Product Declaration (EPD) covers cement products produced Cementos Moctezuma S.A. de C.V. Declared unit: 1 tonne of cement.
Declaration Owner:	Cementos Moctezuma S.A. de C.V. 134 PH Monte Elbruz, Col. Lomas de Chapultepec Ciudad de México, México www.cmoctezuma.com.mx Jair Juan Manuel Martínez Miguel, martinez.jair@cmoctezuma.com.mx
Program Operator:	Labeling Sustainability 700 S. Rosemary West Palm Beach, FL www.labelingsustainability.com/
Product Category Rule:	Core PCR: ISO 21930:2017 Sustainability in building and civil engineering works- Core rules for environmental product declarations of construction products and services SubPCR: (Used as a guidance document only) NSF International (March 2020). Product Category Rules (PCR) for ISO 14025 type III environmental Product Declarations (EPD) of Portland, Blended, Mansory, Mortar and Plastic (stucco) Cements. Valid through March 31, 2025 Sub PCR Program Operator: NSF International Sub-category PCR review was conducted by: Thomas P. Gloria, Ph. D. of Industrial Ecology Consultants: 35 Bracebridge Rd., Newton, MA 02459-1728, tgloria@industrial-ecology.com. Mr. Bill Stough, Sustainable Research Group: PO Box 1684, Grand Rapids, MI 49501-1684, bstough@sustainableresearchgroup.com. Mr. Jack Geilbig, EcoForm: 2624 Abelia Way, Suite 611, Knoxville, TN 37931, jgeilbig@ecoform.com
Independent LCA Reviewer and EPD Verifier:	This EPD was independently verified in accordance with ISO 14025 and ISO 21930. The life cycle assessment was independently reviewed in accordance ISO 14044 and the referenced PCR. Independent verification of the declaration, according to ISO 14025:2006 Internal <input type="checkbox"/> ; External <input checked="" type="checkbox"/> Third Party Verifier Denice V Staaf, 3rd Party Verifier under Labeling Sustainability (www.labelingsustainability.com)
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COMPANY DESCRIPTION

Cementos Moctezuma is a prominent Mexican company established in 1943, specializing in the production, distribution, and marketing of cement, concrete, and aggregates under the well-known brands Cementos Moctezuma and Concretos Moctezuma. Listed on the Mexican Stock Exchange since 1988, the company maintains a strong financial position characterized by discipline and zero debt.

With three cement plants boasting an annual capacity of eight million tons and 30 concrete plants producing over 590 types of concrete, Cementos Moctezuma has an extensive distribution network of more than 530 centers, covering 95% of Mexico. The company also offers value-added services, including specialized technical advice, mobile laboratories, construction supervision, and training.

Cementos Moctezuma is committed to sustainable development, aligning its operations with the United Nations' Sustainable Development Goals through a strategy focused on five pillars: Safety and health, Energy and climate change, Corporate social responsibility, Environment and biodiversity, and Circular economy. The company emphasizes technological innovation and operational efficiency to produce high-quality products while minimizing environmental impact, including reducing CO₂ emissions and optimizing water use.

A qualified team of 1,303 passionate collaborators drives Cementos Moctezuma's mission to promote the construction of a better country for families and future generations while being committed to environmental stewardship. The company also champions equity and inclusion in the construction industry through initiatives like Casco Rosa, which recognizes the contributions of women in the sector. Additionally, Cementos Moctezuma actively engages in social responsibility programs to enhance the quality of life in the communities it serves, reinforcing its status as a consolidated company with deep Mexican roots.

STUDY GOAL

The intended application of this life cycle assessment (LCA) is to comply with the procedures for creating a Type III environmental product declaration (EPD) and publish the EPD for public review on the website, www.labelingsustainability.com. This level of study is in accordance with EPD Product Category Rule (PCR) for Cement published by NSF (2020) and is a PCR in accordance with ISO 21930 for Preparing an Environmental Product Declaration for Portland, Blended Hydraulic, Masonry, Mortar, and Plastic (Stucco) Cements. EPDs for cements that follow other PCRs may not be comparable.; International Standards Organization (ISO) 14025:2006 Environmental labels and declarations, Type III environmental declarations-Principles and procedures; ISO 14044:2006 Environmental management, Life cycle assessment- Requirements and guidelines; and ISO 14040:2006 Environmental management, Life cycle assessment-Principles and framework. The performance of this study and its subsequent publishing is in alignment with the business-to-business (B2B) communication requirements for the environmental assessment of building products. The study does not intend to support comparative assertions and is intended to be disclosed to the public.

This project report was commissioned to differentiate Cementos Moctezuma from their competition for the following reasons: generate an advantage for the organization; offer customers information to help them make informed product decisions; improve the environmental performance of Cementos Moctezuma by continuously measuring, controlling and reducing the environmental impacts of their

products; help project facilitators working on Leadership in Energy and Environmental Design (LEED) projects achieve their credit goal; and to strengthen Cementos Moctezuma's license to operate in the community. The intended audience for this LCA report is Cementos Moctezuma's employees, their suppliers, project specifiers of their products, architects, and engineers. The EPD report is also available for policy makers, government officials interested in sustainability, academic professors, and LCA professionals. This LCA report does not include product comparisons from other facilities.

Only EPDs prepared from cradle-to-grave life-cycle results and based on the same function, reference service life, and quantified by the same functional unit, can be used to assist purchasers and users in making informed comparisons between products. Since EPDs developed under these PCR only cover the cradle-to-gate impacts of portland, blended hydraulic, masonry, mortar, or plastic (stucco) cements, using a declared unit, the results cannot be used to compare products used in different mixtures and construction products. The results from a portland, blended hydraulic, masonry, mortar, or plastic (stucco) cements EPD must be integrated into a comprehensive cradle-to-grave, ISO 14044-compliant LCA in order to compare between different products. The basis of a comparison, where applicable, shall include the product application in accordance with ISO 21930 ASTM (2014).

The PCR for cement, as listed as the subPCR used as a guidance document, includes a variety of ASTM specifications for cement. None of the ASTM standards listed in the PCR covers Rapid Set Cement. Rapid Set Cement falls under ASTM C1600; This is a performance-based specification for hydraulic cement in the same vein as ASTM C1157, included in the PCR. Representatives of CTS Cement appealed to the PCR committee, including the committee chair from NSF. CTS appeals were denied. The difference between the ASTM C1157 specification, which is included in the PCR, and the ASTM C1600 specification, under which Rapid Set Cement falls, is that ASTM C1600 includes rapid-hardening cement. C1157 excludes rapid hardening cement as it requires a minimum set time of 45 minutes.

DESCRIPTION OF PRODUCT AND SCOPE

This EPD is prepared for products classified as UN CPC Group 3744-Cement or CSI MasterFormat Division 03 30 00 Cast-in-Place Concrete.

This EPD primarily reports data from the reference year 2023 for the Apazapan plant, located in Predio Los Gallineros, domicilio conocido, Camino vecinal al Cerro Colorado km 1, Veracruz, México. The Apazapan plant produces a range of portland cement mixes.

This LCA assumes the impacts from products manufactured in accordance with the standards outlined in this report. This LCA is a cradle-to-gate study, and therefore, stages extending beyond the plant gate are not included in this LCA. Excluded stages include transportation of the manufactured material to the construction site; on-site construction processes and components; building (infrastructure) use and maintenance; and "end-of-life" effects.

CEMENT DESIGN SUMMARY

The following tables provide a list of the cement products considered in this EPD along with key performance parameters.

Table 1: Declared products considered in this environmental product declaration

Mix#	Unique name/ID	Short description	Product type	Clinker content, wt%	Resistance @ 28 Days (MPa)
1	CPC40	Cemento Compuesto Clase 40 Resistente a sulfatos	Ordinary Portland	Proprietary	42.9
2	CPC30	Cemento Compuesto Clase 30 Resistente a sulfatos	Ordinary Portland	Proprietary	33.1
3	Mortero	Cemento de Albañilería	Ordinary Portland	Proprietary	9.7

CEMENT DESIGN COMPOSITION

The following table provides mass breakdown (kg per functional unit) of the material composition of each cement design considered. Please note that the breakdown has been randomly altered and is therefore only an approximation; this manipulation is to ensure confidentiality.

Table 2: Cement composition

Product Components	Raw Material, weight%
Clinker	Proprietary
Mineral Additions (limestone and Pozzolana)	30-60.00
Others	0.01-5.00
Total	100.00

SYSTEM BOUNDARIES

The following figure depicts the cradle-to-gate system boundary considered in this study:

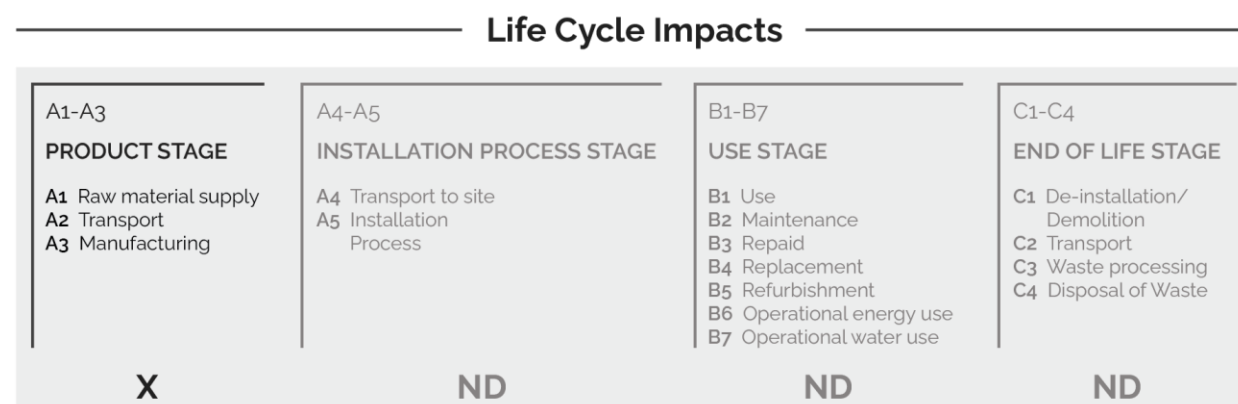


Figure 1: General life cycle phases for consideration in a construction works system

This is a Cradle-to-gate life cycle assessment and the following life cycle stages are included in the study:

- A1: Raw material supply (upstream processes) - Extraction, handling, and processing of the materials used in manufacturing the declared products in this LCA.
- A2: Transportation - Transportation of A1 materials from the supplier to the "gate" of the manufacturing facility (i.e., A3).
- A3: Manufacturing (core processes)- The energy and other utility inputs used to store, move, and manufacture the declared products and to operate the facility.

As according to the PCR, the following figure illustrates the general activities and input requirements for producing cement products and is not necessarily exhaustive.

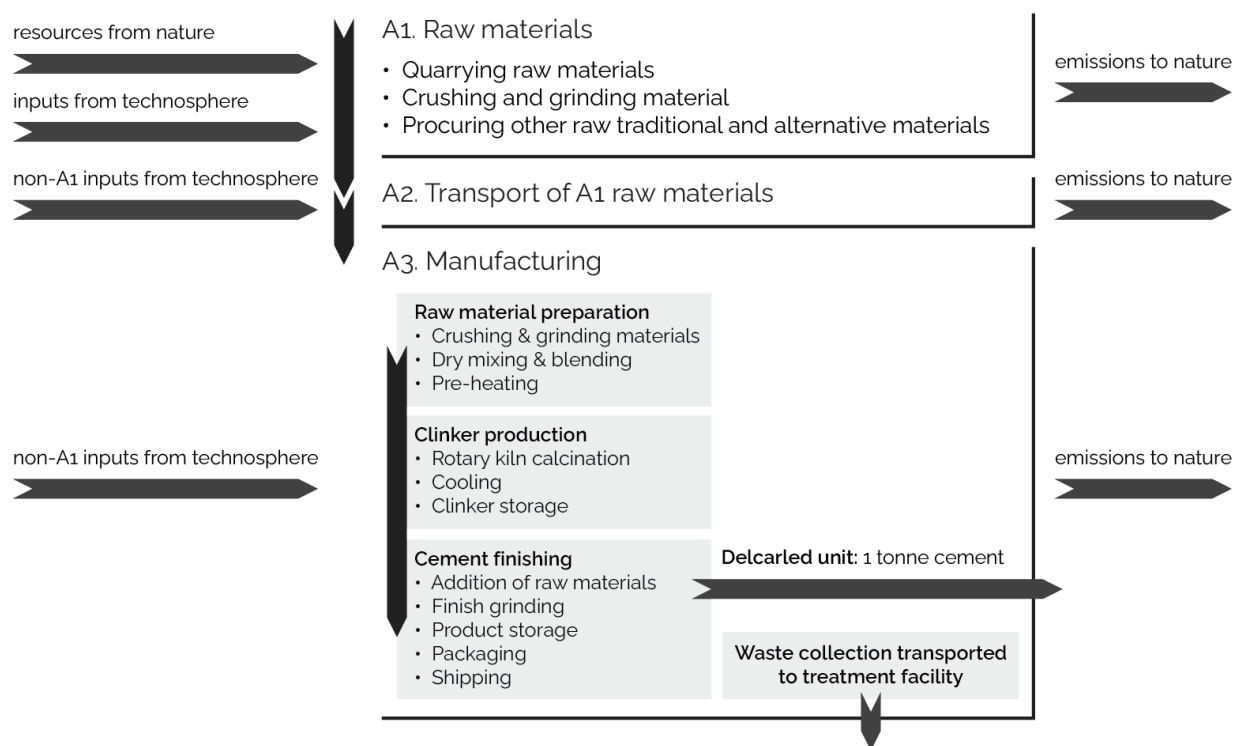


Figure 2: General system inputs considered in the product system and categorized by modules in scope

In addition, as according to the relevant PCR, the following requirements are excluded from this study:

- Production, manufacture and construction of A3 building/capital goods and infrastructure;
- Production and manufacture of steel production equipment, steel delivery vehicles, earth-moving equipment, and laboratory equipment;
- Personnel-related activities (travel, furniture, office supplies);
- Energy use related to company management and sales activities.

For this LCA the manufacturing plant, owned and operated by Cementos Moctezuma, is located at their Planta Apazapan facility in Veracruz. All operating data is formulated using the actual data from Cementos Moctezuma's plant at the above location, including water, energy consumption and waste generation. All inputs for this system boundary are calculated for the plant.

This life cycle inventory was organized in a spreadsheet and was then input into an RStudio environment where pre-calculated LCIA results for relevant products/activities stemming from the ecoinvent v3.10 database and a local EPD database in combination with primary data from Cementos Moctezuma were utilized. Explanations of the contribution of each data source to this study are outlined in the section 'Data Sources and Quality'. Further LCI details for each declared product are provided in the sections 'Detailed LCI tables' and 'Transport tables' of the detailed LCA report. A parameter uncertainty analysis was also performed where key statistical results (e.g. min/mean/max etc.) are provided in the detailed LCA report.

CUT-OFF CRITERIA

ISO 14044:2006 and the focus PCR requires the LCA model to contain a minimum of 95% of the total inflows (mass and energy) to the upstream and core modules be included in this study. The cut-off criteria were applied to all other processes unless otherwise noted above as follows. A 1% cut-off is considered for all renewable and non-renewable primary energy consumption and the total mass of inputs within a unit process where the total of the neglected inputs does not exceed 5%.

DATA SOURCES AND DATA QUALITY ASSESSMENT

Raw material transport: A combination of actual mode/distance combinations were assumed for key bulk materials whereas ecoinvent default multi-modal market mix distances were assumed for other inputs where no original data could be provided.

Electricity: Electricity consumption values are for Moctezuma in calendar year 2023. These values were directly reported from Moctezuma records. The unit process "market for electricity, medium voltage/electricity, medium voltage/MX/kWh" was used to represent the Mexico grid electricity used by the cement plant. The plant utilizes photovoltaic (PV) electricity, which accounts for 16% of its total electricity consumption in 2023. The unit process 'electricity production, photovoltaic, low voltage/MX/kWp' was used to represent the photovoltaic electricity.

Process/space heating: No fuel is used for space heating at this plant.

Fuel required for machinery: Only diesel has been used for fire system, emergency plant, utility cars, track Mobil and construction machinery apart from that no other type of fuel has been used by the plant. Diesel accounting for emission mentioned as A3 in tab 3.

Waste generation: Waste values were based on waste management receipts for 2023.

Recovered energy: Not applicable

Recycled/reused material/components: Not applicable.

Module A1 material losses: Due to lack of data, default loss factors were assumed.

Direct A3 emissions accounting: All direct emissions were entered using a hybrid of direct Cementos Moctezuma emissions calculations from their yearly GHG Facility-Level Emissions report and LCIecoinvent unit processes.

Waste transport requirements: Transportation distances are using estimated values. The waste hauler cannot guarantee the exact distances travelled due to the variation of route and actual location of disposal. Most hazardous waste disposal sites are near the plant therefore the 25 km distance is a representative estimate.

The following tables depict a list of assumed life cycle inventory utilized in the LCA modelling to generate the impact results across the life cycle modules in scope. An assessment of the quality of each LCI activities utilized from various sources is also provided.

Table 3: LCI inputs assumed for module A1 (i.e., raw material supply)

Input	LCI.activity	Data.source	Geo	Year	Technology	Time	Geography	Reliability	Completeness
Coke (to make Clinker batch Type I)	petroleum coke production, petroleum refinery operation/petroleum coke/RoW/kg	ecoinvent v3.10 in 2024	Veracruz	2024	2	3	1	3	3
Limestone (to make Clinker batch Type I)	limestone quarry operation/limestone, unprocessed/RoW/kg ; Note: modifications made (see ecoinvent activity changes table)	ecoinvent v3.10 in 2024	Veracruz	2024	2	3	2	3	3
Iron Residues (to make Clinker batch Type I)	iron ore mine operation, 63% Fe/iron ore, crude ore, 63% Fe/IN/kg	ecoinvent v3.10 in 2024	Veracruz	2024	1	3	0	3	3
electricity, low voltage (to make Clinker batch Type I)	market for electricity, medium voltage/electricity, medium voltage/MX/kWh	ecoinvent v3.10 in 2024	Veracruz	2024	2	3	2	3	3
Clay (to make Clinker batch Type I)	clay pit operation/clay/RoW/kg	ecoinvent v3.10 in 2024	Veracruz	2024	2	3	2	3	3

Heavy Fuel Oil (to make Clinker batch Type I)	heavy fuel oil production, petroleum refinery operation/heavy fuel oil/RoW/kg	ecoinvent v3.10 in 2024	Veracruz	2024	2	3	1	3	3
Gypsum	gypsum quarry operation/gypsum, mineral/RoW/kg; Note: modifications made (see ecoinvent activity changes table)	ecoinvent v3.10 in 2024	Puebla	2024	2	3	2	3	3
Diesel	diesel production, petroleum refinery operation/diesel/RoW/kg	ecoinvent v3.10 in 2024	Veracruz	2024	2	3	2	3	3
FIRSU (to make Clinker batch Type I)	Waste input produced off-site	See A3 inputs	Veracruz	See A3 inputs	2	A3	2	A3	A3

DATA QUALITY ASSESSMENT

Data quality/variability requirements, as specified in the PCR, are applied. This section describes the achieved data quality relative to the ISO 14044:2006 requirements. Data quality is judged based on its precision (measured, calculated or estimated), completeness (e.g., unreported emissions), consistency (degree of uniformity of the methodology applied within a study serving as a data source) and representativeness (geographical, temporal, and technological).

Precision: Through measurement and calculation, the manufacturers collected and provided primary data on their annual production. For accuracy, the LCA practitioner and 3rd Party Verifier validated the plant gate-to-gate data.

Completeness: All relevant specific processes, including inputs (raw materials, energy and ancillary materials) and outputs (emissions and production volume) were considered and modeled to represent the specified and declared products. The majority of relevant background materials and processes were taken from ecoinvent v3.10 LCI datasets where relatively recent region-specific electricity inputs were utilized. The most relevant EPDs requiring key A1 inputs were also utilized where readily available.

Consistency: To ensure consistency, the same modeling structure across the respective product systems was utilized for all inputs, which consisted of raw material inputs and ancillary material, energy flows, water resource inputs, product and co-products outputs, returned and recovered Cement materials, emissions to air, water and soil, and waste recycling and treatment. The same background LCI datasets from the ecoinvent v3.10 database were used across all product systems. Crosschecks concerning the plausibility of mass and energy flows were continuously conducted. The LCA team conducted mass and energy balances at the plant and selected process level to maintain a high level of consistency.

Reproducibility: Internal reproducibility is possible since the data and the models are stored and available in a machine readable project file for all foreground and background processes, and in EPD

Express proprietary Cement LCA calculator* for all production facility and product-specific calculations. A considerable level of transparency is provided throughout the detailed LCA report as the specifications and material quantity make-up for the declared products are presented and key primary and secondary LCI data sources are summarized. The provision of more detailed publicly accessible data to allow full external reproducibility was not possible due to reasons of confidentiality.

EPD Express has developed a proprietary tool that allows the calculation of PCR-compliant LCA results for Cement product designs. The tool auto-calculates results by scaling base-unit technosphere inputs (i.e. 1 kg sand, 1 kWh electricity, etc.) to replicate the reference flow conversions in openLCA.

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

- Time related coverage of the manufacturing processes' primary collected data from 2023-01-01 to 2023-12-31.
- Upstream (background) LCI data was either the PCR specified default (if applicable) or more appropriate LCI datasets as found in the country-adjusted ecoinvent v3.8 database.
- Geographical coverage for inputs required by the A3 facility(ies) is representative of its region of focus; other upstream and background processes are based on US, North American, or global average data and adjusted to regional electricity mixes when relevant.
- Technological coverage is typical or average and specific to the participating facilities for all primary data.

ENVIRONMENTAL INDICATORS AND INVENTORY METRICS

Per the PCR, this EPD supports the life cycle impact assessment indicators and inventory metrics as listed in the tables below. As specified in the PCR, the most recent US EPA Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts (TRACI), impact categories were utilized as they provide a North American context for the mandatory category indicators to be included in the EPD. Additionally, the PCR requires a set of inventory metrics to be reported with the LCIA indicators.

It should be noted that 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 any of the following categories.

LIMITATIONS

This EPD is a declaration of potential environmental impact and does not support or provide definitive comparisons of the environmental performance of specific products. Only EPDs prepared from cradle-to-grave life cycle results and based on the same function and reference service life and quantified by the same functional unit can be used to assist purchasers and users in making informed comparisons between products.

LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks. Further, LCA offers a wide array of environmental impact indicators, and this EPD reports a collection of those, as specified by the PCR.

In addition to the impact results, this EPD provides several metrics related to resource consumption and waste generation. While these data may be informational in other ways, they do not provide a measure of impact on the environment.

TOTAL IMPACT SUMMARY

The following table reports the total LCA results for each product produced at the given cement facility on a per 1 tonne of cement basis.

Table 4: Total life cycle (across modules in scope) impact results for All declared products, assuming the geometric mean point values on a per 1 tonne of cement basis.

a) Midpoint Impact Categories:

Indicator/LCI Metric	GWP	ODP	AP	EP	SFP	ADP _{fossil}
Unit	kg CO ₂ -eq	kg CFC-11-eq	Kg SO ₂ -eq	kg N-eq	kg O ₃ -eq	MJ
CPC40	804	1.14E-06	0.194	0.089	2.64	810
CPC30	654	1.13E-06	0.200	0.090	2.79	815
Mortero	355	1.14E-06	0.217	0.090	3.26	809

b) Resources Inventory Metrics:

Indicator/LCI Metric	RPRE	PRM	NRPRE	NRPRM	SM	RSF	RE	FW
Unit	MJ	MJ	MJ	kg	MJ	MJ	MJ	m ³
CPC40	104	2.5	167	2840	0.618	0.00286	0.145	0.110
CPC30	103	2.5	150	2160	0.497	0.00239	0.119	0.110
Mortero	103	2.5	126	1230	0.334	0.00101	0.083	0.121

c) Waste/output Inventory Metrics:

Indicator/LCI Metric	HWD	NHWD	HLRW	ILLRW	MR	MER	EE _{el}	EE _{heat}
Unit	kg	kg	kg	kg	kg	kg	MJ	MJ
CPC40	1.39	48.06	3.39E-05	0.00108	0.0418	7.50E-06	0.0135	0.0136
CPC30	1.40	48.01	1.07E-04	0.000957	0.042	9.90E-06	0.0612	0.0181
Mortero	1.41	48.35	1.12E-05	0.000796	0.042	1.02E-05	0.0171	0.0187

ADDITIONAL ENVIRONMENTAL INFO

No regulated substances of very high concern are utilized on site.

REFERENCES

ASTM Standards:

- ASTM C150/C150M Standard Specification for Portland Cement

- ASTM C260/C260M Standard Specification for Air-Entraining Admixtures for Concrete
- ASTM C595 Standard Specification for Blended Hydraulic Cements
- ASTM C618 Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
- ASTM C979/C979M Standard Specification for Pigments for Integrally Colored Concrete
- ASTM C989/C989M Standard Specification for Slag Cement for Use in Concrete and Mortars
- ASTM C1017/C1017M Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete
- ASTM C1116/C1116M Standard Specification for Fiber-Reinforced Concrete
- ASTM C1157/C1157M Standard Performance Specification for Hydraulic Cement
- ASTM C1240 Standard Specification for Silica Fume Used in Cementitious Mixtures
- ASTM C1602/C1602M Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete
- ASTM G109 Standard Test Method for Determining Effects of Chemical Admixtures on Corrosion of Embedded Steel Reinforcement in Concrete Exposed to Chloride Environments

CSA Standards:

- CAN/CSA A3000 Cementitious Materials Compendium
- CAN/CSA G40.20/G40.21 General requirements for rolled or welded structural quality steel / Structural quality steel

ISO Standards:

- ISO 6707-1: 2014 Buildings and Civil Engineering Works - Vocabulary - Part 1: General Terms
- ISO 14021:1999 Environmental Labels and Declarations - Self-declared Environmental Claims (Type II Environmental Labeling)
- ISO 14025:2006 Environmental Labels and Declarations - Type III Environmental Declarations - Principles and Procedures
- ISO 14040:2006 Environmental Management - Life Cycle Assessment - Principles and Framework
- ISO 14044:2006 Environmental Management - Life Cycle Assessment - Requirements and Guidelines
- ISO 14067:2018 Greenhouse Gases - Carbon Footprint of Products - Requirements and Guidelines for Quantification
- ISO 14050:2009 Environmental Management - Vocabulary
- ISO 21930:2017 Sustainability in Building Construction - Environmental Declaration of Building Products

EN Standards:

- EN 15804 Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products

Other References:

- US EPA Waste Reduction Model (WARM), Fly Ash Chapter: <http://epa.gov/climatechange/wycd/waste/downloads/fly-ash-chapter10-28-10.pdf>
- USGBC LEED v4 for Building Design and Construction, 11 Jan 2019 available at <https://www.usgbc.org/resources/pcr-committee-process-resources-part-b>
- USGBC PCR Committee Process & Resources: Part B, USGBC, 7 July 2017 available at <https://www.usgbc.org/resources/pcr-committee-process-resources-part-b>.