

# ENVIRONMENTAL PRODUCT DECLARATION

In accordance with ISO 14025 and  
EN 15804:2012+A2:2019 for:  
**GENERAL PURPOSE CEMENT  
"FUERTE"**



**Programme:**

**Programme Operator:**

**EPD registration number:**

**Publication date:**

**Valid until:**

**Geographical scope:**

The International EPD® System,  
[www.environdec.com](http://www.environdec.com)

EPD International AB

S-P-05007

2021-11-02

2026-11-01

Costa Rica

---

## **EXECUTIVE SUMMARY**

This Environmental Product Declaration (EPD) was developed by Holcim (Costa Rica) S.A. under The International EPD® System, according to European Standard CEN EN 15804 and PCR 2019:14 and C-PCR-001 norms. The scope of this study is “Cradle to Gate” covering product stages using modules A1-A3 from the Product Category Rules; for this declaration, modules C1-C4 and D were excluded, since product fulfills the three conditions required by EN 15804:2012+A2:2019.

The declared unit used is one ton of cement (Holcim Fuerte). All environmental performance indicators have been declared for bulk and packaged cement. All primary data used in this study is for the year 2020, at the Holcim cement plant located at Cartago, Costa Rica.

Holcim Fuerte cement delivers a low carbon footprint with the objective of enabling low-carbon construction at scale, and contributing to the achievement of world-class environmental certifications (e.g., LEED®), due to its lower clinker content.

These cements produced by Holcim (Costa Rica) are included within our corporate vision of Sustainability. We invite you to learn more about our study, or to deep dive into any of the details presented here by consulting our technical staff or visiting our website [www.holcim.cr](http://www.holcim.cr).

## CONTENT

<b>1. PROGRAM INFORMATION EPD SYSTEM .....</b>	<b>4</b>
<b>2. COMPANY INFORMATION .....</b>	<b>5</b>
2.1 DESCRIPTION OF THE ORGANIZATION.....	5
2.2 PRODUCT-RELATED OR MANAGEMENT SYSTEM-RELATED CERTIFICATIONS .....	6
2.3 NAME AND LOCATION OF PRODUCTION SITES.....	6
<b>3. PRODUCT INFORMATION .....</b>	<b>7</b>
3.1 PRODUCT NAME.....	7
3.2 PRODUCT IDENTIFICATION .....	7
3.3 UN CPC CODE.....	7
3.4 PRODUCT DESCRIPTION.....	7
3.5 PRESENTATION .....	7
3.6 RECOMMENDED USES.....	7
<b>4. LIFE CYCLE ASSESSMENT (LCA) INFORMATION.....</b>	<b>8</b>
4.1 DECLARED UNIT.....	8
4.2 REFERENCE SERVICE LIFE .....	8
4.3 TIME REPRESENTATIVENESS .....	8
4.4 DATABASE(S) AND LCA SOFTWARE USED .....	8
4.5 DESCRIPTION OF THE SYSTEM BOUNDARIES.....	8
4.6 SYSTEM DIAGRAM.....	9
4.7 DECLARED MODULES .....	9
4.8 OTHER INFORMATION .....	10
<b>5. CONTENT INFORMATION .....</b>	<b>13</b>
<b>6. ENVIRONMENTAL INFORMATION, FUERTE CEMENT, BULK .....</b>	<b>14</b>
6.1 POTENTIAL ENVIRONMENTAL IMPACT PER DECLARED UNIT .....	14
6.2 USE OF RESOURCES .....	15
6.3 WASTE PRODUCTION.....	15
6.4 OUTPUT FLOWS.....	15
6.5 POTENTIAL ENVIRONMENTAL IMPACT - ADDITIONAL INDICATORS .....	16
6.6 INFORMATION ON BIOGENIC CARBON CONTENT .....	16
<b>7. ENVIRONMENTAL INFORMATION, FUERTE CEMENT, BAGGED.....</b>	<b>17</b>
7.1 POTENTIAL ENVIRONMENTAL IMPACT PER DECLARED UNIT .....	17
7.2 USE OF RESOURCES .....	18
7.3 WASTE PRODUCTION.....	18
7.4 OUTPUT FLOWS.....	18
7.5 POTENTIAL ENVIRONMENTAL IMPACT - ADDITIONAL INDICATORS .....	19
7.6 INFORMATION ON BIOGENIC CARBON CONTENT .....	19
<b>8. RESULTS ANALYSIS .....</b>	<b>20</b>
8.1 CONTRIBUTION OF THE DECLARED MODULES TO THE ENVIRONMENTAL IMPACT INDICATORS .....	20
8.2 CONTRIBUTION OF THE DECLARED MODULES TO THE INDICATORS OF USE OF RESOURCES .....	22
8.3 CONTRIBUTION OF THE DECLARED MODULES TO THE WASTE FLOW INDICATORS .....	23
8.4 CONTRIBUTION OF THE DECLARED MODULES TO THE OUTPUT FLOW INDICATORS.....	24
8.5 CONTRIBUTION OF THE DECLARED MODULES TO THE ADDITIONAL INDICATORS.....	25
<b>9. ADDITIONAL INFORMATION.....</b>	<b>26</b>
9.1 ORIGIN OF RAW MATERIALS .....	26
9.2 AIR EMISSIONS - VOC .....	26
<b>10. DIFFERENCES COMPARED TO PREVIOUS VERSIONS OF THE EPD .....</b>	<b>26</b>
<b>11. REFERENCES.....</b>	<b>27</b>

## 1. PROGRAM INFORMATION EPD SYSTEM

Programme:	<b>The International EPD® System</b>
Address:	EPD International AB BOX 210 60 SE-100 31 Stockholm Sweden
Website:	<a href="http://www.environdec.com">www.environdec.com</a>
E-mail:	<a href="mailto:info@environdec.com">info@environdec.com</a>

<b>The CEN EN 15804 standard serves as the core product category rules (PCR) and is supplemented by CEN EN 16908: 2017</b>	
<b>Product Category Rules (PCR):</b>	PCR 2019:14 Construction Products v1.11 c-PCR-001 to PCR 2019:14
<b>The PCR review was performed by:</b>	The Technical Committee of the International EPD® System. See <a href="http://www.environdec.com/TC">www.environdec.com/TC</a> for a list of members. Review chair: Claudia A. Peña, Universidad de Concepción, Chile. The review panel may be contacted via the Secretariat at <a href="http://www.environdec.com/contact">www.environdec.com/contact</a>
<b>Independent third-party verification of the declaration and data, according to ISO 14025:2006:</b>	<input type="checkbox"/> EPD process certification <input checked="" type="checkbox"/> EPD verification
<b>Third party verifier:</b>	Marcel Gómez Ferrer. Marcel Gomez Environmental Consulting. <a href="mailto:info@marcelgomez.com">info@marcelgomez.com</a>
<b>Approved by:</b>	The International EPD® System
<b>Procedure for follow-up of data during EPD validity involves third party verifier:</b>	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No

The EPD owner has the sole ownership, liability, and responsibility for this EPD. EPDs within the same product category, but from different programs may not be comparable. EPDs of construction products may not be comparable, if they do not comply with EN 15804. For further information about comparability, see European Standard EN 15804, and International Organization for Standardization ISO 14025.



## 2. COMPANY INFORMATION

Owner of the EPD: Holcim (Costa Rica) SA

Contact: Catalina Mora, [catalina.morar@holcim.com](mailto:catalina.morar@holcim.com)

### 2.1 Description of the organization

Holcim (Costa Rica) S.A. has been in the country since 1964. It believes in building a world that works for both people and the planet. A world that allows people to live safely, connected, and promotes common welfare.

Through the application of high standards (national and international) that guarantee a safe work environment "Zero Harm", the care of the environment helps develop policies for an inclusive and diverse workplace. That is why we are shaping the way we are moving forward, on our journey to become a "Net Zero" company.



On our way to becoming a "Net Zero" company, we are:

- Promoting sustainable construction
- The first global building materials company to sign the United Nations Global Compact (UNGC) "Business Ambition for 1.5°C" initiative with goals
- Working on a 2030 action plan verified by Science Based Targets initiatives (SBTi).

As part of this ambition, Holcim Costa Rica is working with a strong focus on sustainability; we want to transform the way our Industry works, and encourages the construction sector to play a role in the most important problems of our planet e.g. Climate Change, Resources, Waste, etc. For this reason, our vision of sustainability for the year 2030 goes beyond the actions that a company must take to reduce its impact, and focuses on four areas:

- 1) Protect the climate by reducing our Green House Gases (GHG) emissions.
- 2) Conserve water resources and biodiversity.
- 3) Adopt a Circular Economy model and optimization of resources.
- 4) Improve the quality of life of our stakeholders and community.

The main actions that have allowed us to reduce the environmental impact of our activities and the footprint of the product portfolio are:

- The use of alternative fuels to replace the consumption of traditional fossil fuels used for the cement production process.

- Automation of the operation to guarantee the highest energy efficiency of the process.
- Heat recovery in the system to reduce the thermal consumption of the process.
- Use of added minerals (pozzolana and limestone) to optimize the composition of the cement and improve its properties.
- Improve cement performance, and increase its strength through the use of grinding additives.
- Comprehensive control of fuels and raw materials used in the production process to minimize the impact on emissions.
- Use of continuous online monitoring of emissions with state-of-the-art equipment.
- Preventive and Corrective maintenance of equipment, such as bag filters and electro filters to reduce emissions of particulate matter.

From the point of view of the construction cycle, having products with a lower carbon footprint, or with significant CO<sub>2</sub> reductions contributes in mitigating the environmental impact generated by the sector and encourages changes in the traditional way of building.

Holcim Costa Rica, is committed to the Sustainable Development Goals (SDG) and the national decarbonization strategy, and has put its efforts into making Environmental Product Declarations (EPD), which evaluate the global warming potential (GWP), among other environmental impacts, of materials of construction, based on the amount of energy required during the manufacturing process,

and the environmental impact of extracting or producing raw materials, and the fuel used for delivery of finished products. These documents comply with international ISO standards and are recognized by certification schemes for sustainable construction, such as Leadership in Energy and Environmental Design (LEED) v4.

The results presented in these EPDs will be used as information for decision-making by designers, developers, and builders, in the phases of design, specification, and selection of materials with a vision of environmental responsibility, and promotion of sustainable construction, with a focus in life cycle.

## **2.2 Product-related or management system-related certifications**

Holcim's Cartago cement plant has an integrated management system certified according to ISO 9001:2015 "Quality Management", and ISO 14001:2015 "Environmental Management Standards". Additionally, the organization's greenhouse gas emissions inventory is verified according to the requirements of the ISO 14064-1:2006 "Green House Gases" standard, and the calculation of the Product Footprint for all Cements is carried out in compliance with the ISO 14067 "Green House Gases for Products" standard verified by a third-party certification body Instituto de Normas Tecnicas de Costa Rica (INTECO).

## **2.3 Name and location of production sites**

The Holcim Cement Plant is in Agua Caliente de Cartago, Costa Rica.

### 3. PRODUCT INFORMATION

#### 3.1 Product Name

Holcim Fuerte Cement. General purpose Hydraulic Cement

#### 3.2 Product Identification

Type MM/C (CP)-28 (RTCR 479: 2015)

#### 3.3 UN CPC Code

Holcim Fuerte cement is classified in the CPC 3744 category "Portland cement, aluminous cement, slag cement and similar hydraulic cements, except in the form of clinkers" under the UN CPC v2.1 classification system.<sup>1</sup>

#### 3.4 Product Description

Holcim Fuerte cement is recommended for preparing general-purpose concretes, and mortars that do not require high initial strength. Its controlled Tricalcium Aluminate ( $C_3A$ ) content of no more than 8%, provides a moderate heat of hydration which favors the reduction of surface cracking due to shrinkage, when the curing parameters are adequately controlled.

The inclusion of high-grade Holcim Limestone gives it better attributes in terms of plasticity in the fresh state of the mixtures, and reduces the water requirement to reach the desired workability parameters.

#### 3.5 Presentation

- 50 kg cement bags
- Bulk cement

#### 3.6 Recommended Uses

- Structural type concretes: beams, columns, foundations
- Stamps, slabs, sidewalks
- Repairs and remodeling
- Wall repels
- Cell fill concretes
- Production of masonry elements
- Ready-mix concrete
- Prepackaged dry mortars and concretes
- Injection grouts



<sup>1</sup> <https://unstats.un.org/unsd/classifications/Econ/cpc>

## 4. LIFE CYCLE ASSESSMENT (LCA) INFORMATION

### 4.1 Declared Unit

1 ton of cement, bulk or bagged

EPD tool for cement and concrete (V3.0) software.

### 4.2 Reference service life

As cement is integrated as the main component of concrete and mortars, the reference service life of cement-based products is estimated to exceed 50 years, due to their components and design characteristics. Due to the potential for loss of its properties, when exposed to environmental conditions of temperature and humidity, the recommended shelf life for cement is 45 days. It is recommended to maintain cement in adequate storage conditions, as indicated by the Portland Cement Association (PCA), and American Concrete Institute (ACI) [ACI chapter 2, and Chapter 304 section 2.3].

### 4.3 Time representativeness

The production data correspond to the period from January 1, 2020, to December 31, 2020. Other reference data correspond to the latest available version of Ecoinvent 3.6 Life Cycle Database.

### 4.4 Database(s) and LCA software used

Ecoinvent Database 3.6. Life Cycle Analysis model was developed using Global Cement and Concrete Association (GCCA) Industry

### 4.5 Description of the system boundaries

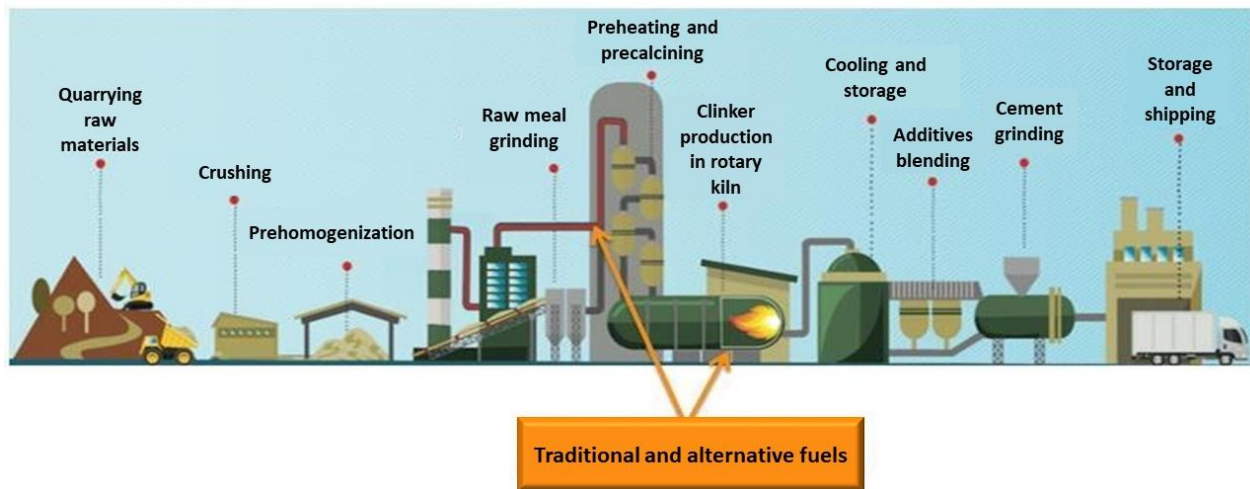
The scope of the LCA study covers the modules from Cradle to Gate (A1-A3), in accordance with the requirements of the PCR 2019:14 "Construction Products", and the EN 15804:2012+A2:2019 standard. Cement products meet the following characteristics:

- The material is physically integrated with other products during its installation, in such a way that these cannot be physically separated at the end of their useful life.
- The material is not identifiable at the end of its useful life because of a physical and chemical transformation process.
- The material does not contain biogenic carbon.

The analysis of the system includes all phases of the life cycle, from the extraction and supply of raw materials, the consumption of energy and materials, and the primary and secondary manufacturing processes (their inputs and outputs), to the finished and/or packaged product at the end of the manufacturing stage, as required by the "Cradle to Gate" option of the Reference PCR. The environmental impacts have been evaluated considering all the phases of the life cycle of the product in accordance with the rules listed in the PCR 2019:14.



#### 4.6 System Diagram



#### 4.7 Declared modules

	Product stage			Construction process stage		Use stage							End of life stage				Resource recovery stage
	Raw material supply	Transport	Manufacturing	Transport	Construction installation	Use	Maintenance	Repair	Substitution	Rehabilitation	Operational energy	Operational water use	Deconstruction - demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling Potential
Module	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Declared module	X	X	X	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Geography	CR	CR	CR	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Specific data used	> 90%					-	-	-	-	-	-	-	-	-	-	-	-
Variation - products	Not relevant					-	-	-	-	-	-	-	-	-	-	-	-
Variation - sites	Not relevant					-	-	-	-	-	-	-	-	-	-	-	-

X: Declared module. ND: Not declared

##### Product stage (A1-A3):

A1 - Supply of raw materials (upstream process): includes raw materials (from the

quarry), fuels, additions, and other inputs for the production activities.

- Primary and secondary raw materials
- Primary and secondary fuels

A2 - Transport of raw materials to the production site (main process): includes the processes of transport and supply of raw materials, fuels additives, and other inputs from local suppliers, and their place of origin, to the production plant.

- Ground transportation
- Maritime transport

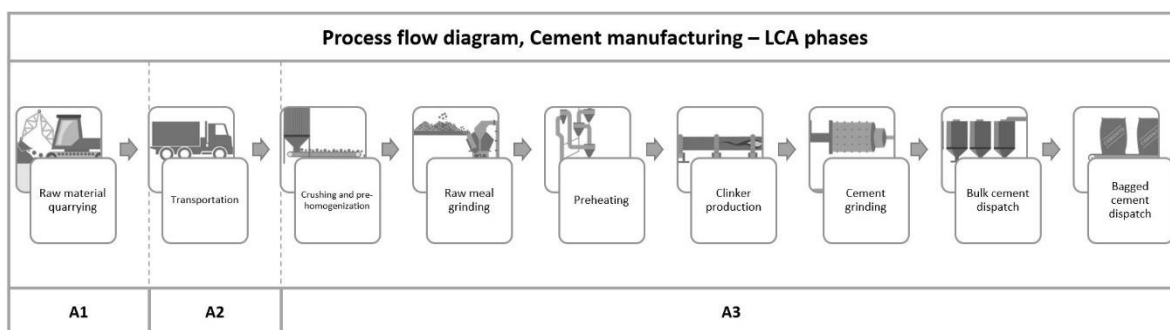
A3 - Clinker manufacturing (main process): includes limestone crushing, pre-homogenization, raw meal preparation and homogenization, pre-calcining, and clinker manufacturing processes in a rotary kiln, with cooling and storage.

- Power consumption

- Primary fuels
- Secondary fuels
- Transportation fuels
- Industrial water
- Hazardous and non-hazardous waste

A3 - Cement Production: begins with the preparation of raw materials, grinding cement, packaging, and storage for dispatch.

- Power consumption
- Primary fuels
- Transportation fuels
- Non-hazardous waste
- Additives
- Packing materials



## 4.8 Other information

### 4.8.1 Assumptions

- Transportation of raw materials: The data reported for the transportation of raw materials and other supplies, are estimates of distances traveled for supply from the producer or distributor facilities. Additionally, land and maritime transport distances have been considered for materials produced outside the national territory. Travel and return distances were considered for land transport by road.

- Transportation of primary fuels: A generic maritime transportation scenario is assumed from the Gulf Coast in the US to Costa Rica, according to the annual report of the national fuel distributor (RECOPE).
- Carbon emissions: Based on the methodology of the CO<sub>2</sub> and energy Protocol of the Global Cement and Concrete Association (GCCA) and through stoichiometric calculations, the annual calcination factor is determined in kg CO<sub>2</sub>/ton clinker. The determination of emissions of primary and secondary fuels

is carried out based on the CO<sub>2</sub>e emission factors determined by the GCCA protocol and tool, in kg CO<sub>2</sub> / MJ.

- The electricity matrix was calculated with data from the Costa Rica Energy Control Center for year 2020, according to the distribution presented in the table below.

Primary energy source	%
Thermal	0.22
Biomass (bagasse)	0.53
Water	69.52
Geothermal	15.33
Solar	0.080
Wind	13.24
Imported	1.08

#### 4.8.2 Cutting rules

- The data collected covers all raw materials, supplies and packaging materials; associated transportation to the manufacturing site; processes with energy consumption and water use; waste from the production phase and emissions to air and water.
- According to EN 15804 and the reference PCR, flows can be omitted (cut off) from a central process in the LCA up to a maximum of 1% of the total mass of material inputs or 1% of the total energy content of fuels and energy.
- Consumption of raw materials, and energy were recorded using automated equipment and processes, mainly under metrological control.
- The calorific value data of the fuels used were recorded by means of laboratory analysis, in accordance with international standards of American Society for Testing and Materials (ASTM), and the use of equipment under metrological control.
- In general, the activity data was obtained from complete records of annual production; the data in such records was derived using reliable equipment, typical of a single production site, with a temporal correlation between 1 and 10 years with respect to the sets of the database, and with a local geographic correlation vs representative sets of a larger area, and with an equal or similar technological correlation, with respect to the database flows.
- The company has an integrated management system, developed according to the standards INTE / ISO 9001:2015, INTE / ISO 14001:2015, INTE / ISO 14064-1:2019 and INTE B5:2016, certified by the Institute of Technical Standards of Costa Rica. All certifications ensure a process approach, together with their measurement and monitoring, through quality and environmental performance indicators, audited internally and externally on an annual basis.
- To ensure the conformity of the product, the quality control laboratory is accredited under the INTE/ISO 17025:2017 standard, and works following the standard and technical regulation of RTCR-479:2015. Additionally, the carbon footprint of the

#### 4.8.3 Data quality

- All data was recorded daily, via production lots records. Weekly, monthly and annual reports were implemented as part of the operational and financial control. All data was obtained directly from the company for operational year 2020.

products is determined and certified under the INTE/ISO 14067:2019 standard.

#### **4.8.4 Allocation rules**

- Whenever possible, allocation was avoided. The production was divided into two main processes, Clinker and Cement, and the input and output data related to each one was collected. In some cases, the data could not be directly attributed to the production of the specific product, so they were assigned by physical properties (i.e., mass).
- All raw material consumption is based on a specific product formulation, and data is recorded for each product under the company's quality control system, including all inputs for the production process (e.g. additives).
- The allocation of electrical energy consumption for each cement product was calculated from the internal records measured by independent process meters, for the manufacturing of each product.
- For common consumptions, such as water consumption, as well as common production outputs, such as furnace emissions and solid waste generation, a total allocation was made based on the

total annual production of clinker, this being the main raw material of cement.

- The allocation of the packaging paper was made by subtracting the weight of the products sold in bulk, since only the product in bags needs packaging.

#### **4.8.5 Impact assessment methods**

- The characterization methods meet the specifications of the EN 15804:2012+A2:2019 standard, including IPCC (EF), WMO, ReCiPe, CML, AWARE, SETAC-UNEP, USEtox, LANCA, among others.

#### **4.8.6 Information excluded**

- The environmental impact of infrastructure, construction, production equipment and tools that are not directly consumed in the production process are not accounted for in the LCA.
- Impacts related to personnel, such as transportation to and from work, are also not accounted for in the LCA.

#### **4.8.7 ACV developer:**

- The Life Cycle Analysis (LCA) report was carried out by BIOMATECH Engineering Ltd, for Holcim (Costa Rica) S.A.

## 5. CONTENT INFORMATION

Product components	Distribution of raw materials, %	Post-consumer material, % by weight of raw material	Renewable material, % by weight of raw material
Clinker Portland	45.0% - 64.0%	0.43%	0.00%
Mineral additions (limestone and pozzolana)	36.0% - 55.0%	0.00%	0.00%
Others	0.00% - 5.00%	0.00%	0.00%
<b>TOTAL</b>	<b>100%</b>	<b>0.19% - 0.27%</b>	<b>0.00%</b>
Packing materials	Weight, kg	Weight - % (versus product - 1 ton)	
Wooden pallet	12.5	1.25%	
Kraft paper	2.30	0.23%	
<b>TOTAL</b>	<b>14.8</b>	<b>1.48%</b>	

**Declaration of dangerous substances:** Declared products contain less than 0.1% or no hazardous substance, from the “Candidate list of Substances of Very High Concern”, updated 07/08/2021. All cement products declared here comply with the REACH Regulation (CE) No. 1907/2006, regarding the registration, evaluation, authorization and restriction of chemical substances.





## 6. ENVIRONMENTAL INFORMATION, FUERTE CEMENT, BULK

Results are reported separately for 1 metric ton of Fuerte cement, bulk presentation.

### 6.1 Potential Environmental Impact per Declared Unit

PARAMETER	UNIT	A1 + A2 + A3 (bulk)
GWP - total	kg CO <sub>2</sub> eq.	5.77E+02
GWP - fossil	kg CO <sub>2</sub> eq.	5.77E+02
GWP - biogenic	kg CO <sub>2</sub> eq.	7.89E-02
GWP - luluc	kg CO <sub>2</sub> eq.	1.44E-01
ODP	kg CFC 11 eq.	9.04E-06
AP	mol H <sup>+</sup> eq.	1.05E+00
EP - freshwater <sup>2</sup>	kg PO <sub>4</sub> <sup>3-</sup> eq.	2.07E-02
EP - freshwater <sup>2</sup>	kg P eq.	6.74E-03
EP - marine	kg N eq.	5.21E-04
EP - terrestrial	mol N eq.	4.36E+00
POCP	kg NMVOC eq.	1.08E+00
ADP - minerals & metals <sup>2</sup>	kg Sb eq.	9.72E-05
ADP - fossil <sup>2</sup>	MJ	7.66E+02
WDP <sup>2</sup>	m <sup>3</sup>	3.09E+01
Acronyms	GWP-fossil = Global Warming Potential fossil fuels; GWP-biogenic = Global Warming Potential biogenic; GWP-luluc = Global Warming Potential land use and land use change; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential, Accumulated Exceedance; EP-freshwater = Eutrophication potential, fraction of nutrients reaching freshwater end compartment; EP-marine = Eutrophication potential, fraction of nutrients reaching marine end compartment; EP-terrestrial = Eutrophication potential, Accumulated Exceedance; POCP = Formation potential of tropospheric ozone; ADP-minerals&metals = Abiotic depletion potential for non-fossil resources; ADP-fossil = Abiotic depletion for fossil resources potential; WDP = Water (user) deprivation potential, deprivation-weighted water consumption	

*Disclaimer:*

<sup>2</sup> The results of this environmental impact indicator should be used with care as the uncertainties in these results are high and experience with this parameter is limited.

## 6.2 Use of Resources

PARAMETER	UNIT	A1 + A2 + A3 (bulk)
PERE	MJ	6.61E+02
PERM	MJ	0.00E+00
PERT	MJ	6.61E+02
PENRE	MJ	8.29E+02
PENRM	MJ	0.00E+00
PENRT	MJ	8.29E+02
SM	kg	4.36E+00
RSF	MJ	0.00E+00
NRSF	MJ	1.35E+03
FW	m <sup>3</sup>	7.74E-01
Acronyms	PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used as raw materials; PENRT = Total use of non-renewable primary energy re-sources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water	

## 6.3 Waste Production

PARAMETER	UNIT	A1 + A2 + A3 (bulk)
HWD	kg	0.00E+00
NHWD	kg	2.60E-02
RWD	kg	0.00E+00
Acronyms	HWD: Hazardous waste disposed, NHWD: Non-hazardous waste disposed, RWD: Radioactive waste disposed.	

## 6.4 Output Flows

PARAMETER	UNIT	A1 + A2 + A3 (bulk)
CRU	kg	3.10E-03
MFR	kg	9.16E-02
MER	kg	9.53E-02
EE	MJ	0.00E+00
Acronyms	CRU: Components for reuse, MFR: Materials for recycling, MER: Materials for energy recovery, EEE: Exported energy.	

## 6.5 Potential Environmental Impact - Additional Indicators

PARAMETER	UNIT	A1 + A2 + A3 (bulk)
CC	kg CO <sub>2</sub> eq.	3.39E+02
CWRS	kg CO <sub>2</sub> eq.	0.00E+00
CWNRS	kg CO <sub>2</sub> eq.	4.98E+01
Acronyms	CC: emissions from calcination and removals by carbonation; CWRS: emissions from combustion of waste from renewable sources; CWNRS: emissions from combustion of waste from non-renewable sources	

## 6.6 Information on Biogenic Carbon Content

BIOGENIC CARBON CONTENT	UNIT	AMOUNT
Biogenic carbon content in the product	kg C	0.00
Biogenic carbon content in packaging	kg C	0.00

*Note: 1 kg of biogenic carbon is equivalent to 44/12 kg CO<sub>2</sub>.*



## 7. ENVIRONMENTAL INFORMATION, FUERTE CEMENT, BAGGED

Results are reported separately for 1 metric ton of Fuerte cement, bagged presentation.

### 7.1 Potential Environmental Impact per Declared Unit

PARAMETER	UNIT	A1 + A2 + A3 (bagged)
GWP - total	kg CO <sub>2</sub> eq.	5.85E+02
GWP - fossil	kg CO <sub>2</sub> eq.	5.84E+02
GWP - biogenic	kg CO <sub>2</sub> eq.	1.10E-01
GWP - luluc	kg CO <sub>2</sub> eq.	1.92E-01
ODP	kg CFC 11 eq.	9.80E-06
AP	mol H <sup>+</sup> eq.	1.10E+00
EP - freshwater <sup>3</sup>	kg PO <sub>4</sub> <sup>3-</sup> eq.	2.93E-02
EP - freshwater <sup>3</sup>	kg P eq.	9.56E-03
EP - marine	kg N eq.	9.43E-04
EP - terrestrial	mol N eq.	4.48E+00
POCP	kg NMVOC eq.	1.13E+00
ADP - minerals & metals <sup>3</sup>	kg Sb eq.	1.30E-04
ADP - fossil <sup>3</sup>	MJ	8.74E+02
WDP <sup>3</sup>	m <sup>3</sup>	3.73E+01
Acronyms	GWP-fossil = Global Warming Potential fossil fuels; GWP-biogenic = Global Warming Potential biogenic; GWP-luluc = Global Warming Potential land use and land use change; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential, Accumulated Exceedance; EP-freshwater = Eutrophication potential, fraction of nutrients reaching freshwater end compartment; EP-marine = Eutrophication potential, fraction of nutrients reaching marine end compartment; EP-terrestrial = Eutrophication potential, Accumulated Exceedance; POCP = Formation potential of tropospheric ozone; ADP-minerals&metals = Abiotic depletion potential for non-fossil resources; ADP-fossil = Abiotic depletion for fossil resources potential; WDP = Water (user) deprivation potential, deprivation-weighted water consumption	

Disclaimer:

<sup>3</sup> The results of this environmental impact indicator should be used with care as the uncertainties in these results are high and experience with this parameter is limited.

## 7.2 Use of Resources

PARAMETER	UNIT	A1 + A2 + A3 (bagged)
PERE	MJ	8.09E+02
PERM	MJ	2.52E+02
PERT	MJ	1.06E+03
PENRE	MJ	9.55E+02
PENRM	MJ	0.00E+00
PENRT	MJ	9.55E+02
SM	kg	4.36E+00
RSF	MJ	0.00E+00
NRSF	MJ	1.35E+03
FW	m <sup>3</sup>	9.44E-01
Acronyms	PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used as raw materials; PENRT = Total use of non-renewable primary energy re-sources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water	

## 7.3 Waste Production

PARAMETER	UNIT	A1 + A2 + A3 (bagged)
HWD	kg	0.00E+00
NHWD	kg	2.60E-02
RWD	kg	0.00E+00
Acronyms	HWD: Hazardous waste disposed, NHWD: Non-hazardous waste disposed, RWD: Radioactive waste disposed.	

## 7.4 Output Flows

PARAMETER	UNIT	A1 + A2 + A3 (bagged)
CRU	kg	3.10E-03
MFR	kg	1.38E-01
MER	kg	9.63E-02
EE	MJ	0.00E+00
Acronyms	CRU: Components for reuse, MFR: Materials for recycling, MER: Materials for energy recovery, EEE: Exported energy.	



## 7.5 Potential Environmental Impact - Additional Indicators

PARAMETER	UNIT	A1 + A2 + A3 (bagged)
CC	kg CO <sub>2</sub> eq.	3.39E+02
CWRS	kg CO <sub>2</sub> eq.	0.00E+00
CWNRS	kg CO <sub>2</sub> eq.	4.98E+01
Acronyms	CC: emissions from calcination and removals by carbonation; CWRS: emissions from combustion of waste from renewable sources; CWNRS: emissions from combustion of waste from non-renewable sources	

## 7.6 Information on Biogenic Carbon Content

BIOGENIC CARBON CONTENT	UNIT	AMOUNT
Biogenic carbon content in the product	kg C	0.00
Biogenic carbon content in packaging	kg C	5.78

*Note: 1 kg of biogenic carbon is equivalent to 44/12 kg CO<sub>2</sub>.*

## 8. RESULTS ANALYSIS

Environmental declarations for products within the same product category from different programs may not be comparable. Likewise, the results of this Environmental Declaration for construction products may not be comparable with other EPDs, if they do not comply with the EN 15804:2012+A2: 2019 standard.

The following interpretation of the results is representative of the average for one ton of Holcim Fuerte cement.

In general, the environmental impact potentials, and their indicators are dominated by the Clinker manufacturing stage (main cement raw material) followed by the extraction and transportation of raw

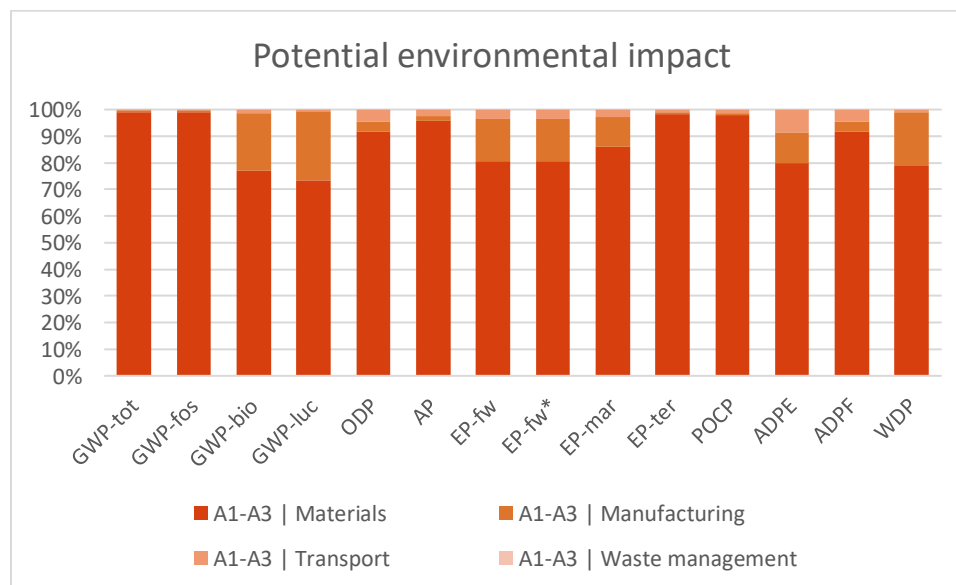
materials, also including fuels for the manufacturing stage.

The results obtained by Holcim Costa Rica for each of the impact categories and their associated indicators for the production of Holcim Fuerte cement (bagged) are presented below.

The graphs for the bulk presentation are not shown due to the similarity of the distributions of the impact categories with those of bagged presentation.

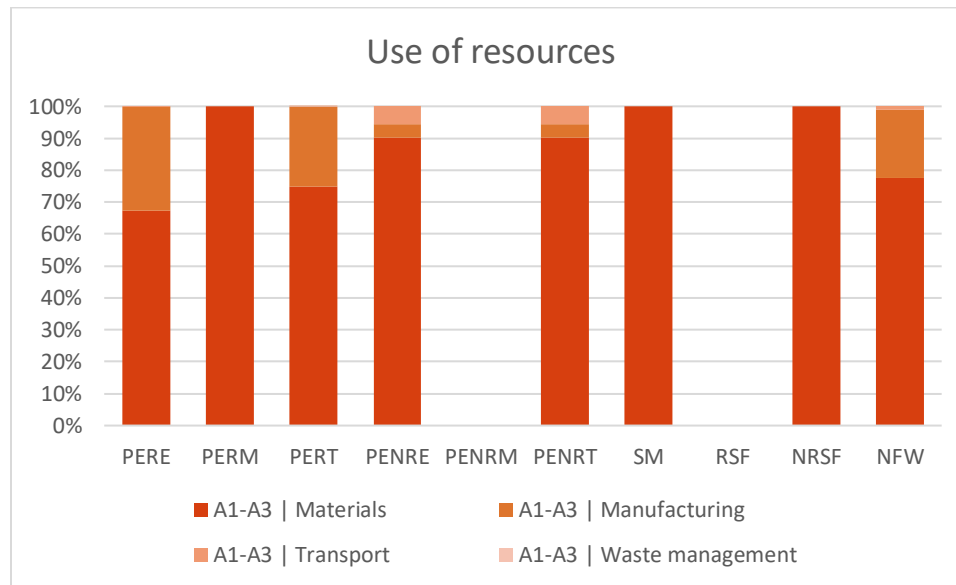
Whenever it is appropriate, the impact of the packaging materials corresponding to the bagged presentation will be addressed in the following discussion.

### 8.1 Contribution of the declared modules to the Environmental Impact Indicators



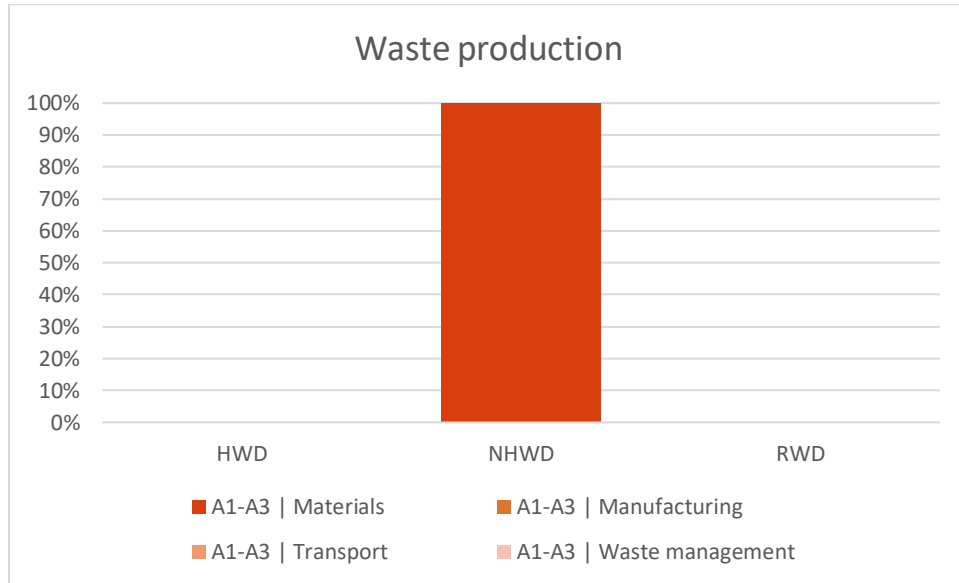
- Carbon dioxide and methane emissions from the use of energy resources, electricity and fuels, are the main source of contribution in the clinker manufacturing process to the Global Warming Potential (GWP) indicators, with the GWP-fossil indicator representing the most important with respect to the total registered (>99%). Through the optimization of the Clinker factor in the cement formulation the impact potential is reduced.
- The Acidification Potential (AP), Ozone Depletion Potential (ODP) and Eutrophication Potential (EP) indicators are mainly associated with emissions into the atmosphere from the clinker manufacturing process, specifically emissions of nitrogen oxides, sulfur oxides and volatile organic compounds being the most significant contribution. The cement plant has technology in its clinker kiln, and in the pre-calcining tower that allows it to operate with high environmental standards, thus reducing its NO<sub>x</sub> and SO<sub>2</sub> emissions. This condition, with the company's efforts to analyze and control the composition of its raw materials and fuels, continuously control atmospheric emissions. The reduction of consumption of traditional fossil fuels by substitution with alternative fuels, are reflected in the aforementioned indicators.
- The influence of transport in the manufacture of clinker is mainly caused by the transport of domestic raw materials and the transport of imported fuels, with the ODP, EP, Abiotic Depletion Potential for non-fossil resources (ADPE) and Abiotic Depletion for fossil resource Potential (ADPF) indicators being those where the contribution exceeds 20% of the magnitude of the results. In the case of cement production, the impact from the transport of raw materials and fuels is of less significance, not exceeding 10% of the results obtained for each indicator. To a lesser extent, the contribution of the extraction phase of raw materials in the manufacture of Clinker of <10% is identified.
- The results from the ADPF indicator show that the production processes are characterized by the lower demand for fossil resources, due to the national electricity matrix, primarily based on renewable sources, as well as the high substitution of traditional fossil fuels for alternative ones.
- The Water Deprivation Potential (WDP) indicator shows a lower impact regarding water consumption. This is because of the local conditions of high availability of water resources, and the efficient use of water through a closed recirculation system in the manufacturing operation.

## 8.2 Contribution of the declared modules to the indicators of Use of Resources



- The results of the resource use indicators of the Fuerte cement production process show that the greatest source of impacts is the supply and manufacture of raw materials (clinker), which represents the main consumption of renewable primary energy resources (national electricity matrix) of >70% of Total Use of Renewable Primary Energy Resource (PERT), as well as the main consumption of non-renewable primary energy resources (fossil fuels) of > 90% of Non-Renewable Primary Energy Resource (PERNT).
- The results from the Use of Renewable Primary Energy excluding Primary Energy Resources used as raw material (PERE) indicator come from the use electricity from the of highly renewable national energy matrix, in contrast with other countries from the region.
- For the cement results, the indicator of Use of renewable Primary Energy resources used as Raw Materials (PERM), is determined by the materials for packaging and dispatch that include wood on pallets and paper in packaging bags.
- The use of alternative fossil fuels from pre-classified municipal and industrial solid waste, one of the company's key impact mitigation strategies, determines the contribution to the Non-Renewable Secondary Fuel Use Indicator (NRSF). The result of this strategy stands out in the reduction of the PERNT indicator in exchange for a wide increase of the NRSF.
- The Secondary Materials (SM) indicator is defined by the recovery and use of iron oxide waste (industrial origin) and glass waste (post-consumer origin and industry), which contributes to reducing the demand for primary renewable resources in the clinker manufacturing and is proportionally reflected in the cement result.
- The use of fresh water, Net Use of Fresh Water (NFW), originates mainly from the direct consumption of the operation, which has a recirculation process to supply the multiple cooling systems, and thus, significantly reduce the local impact.

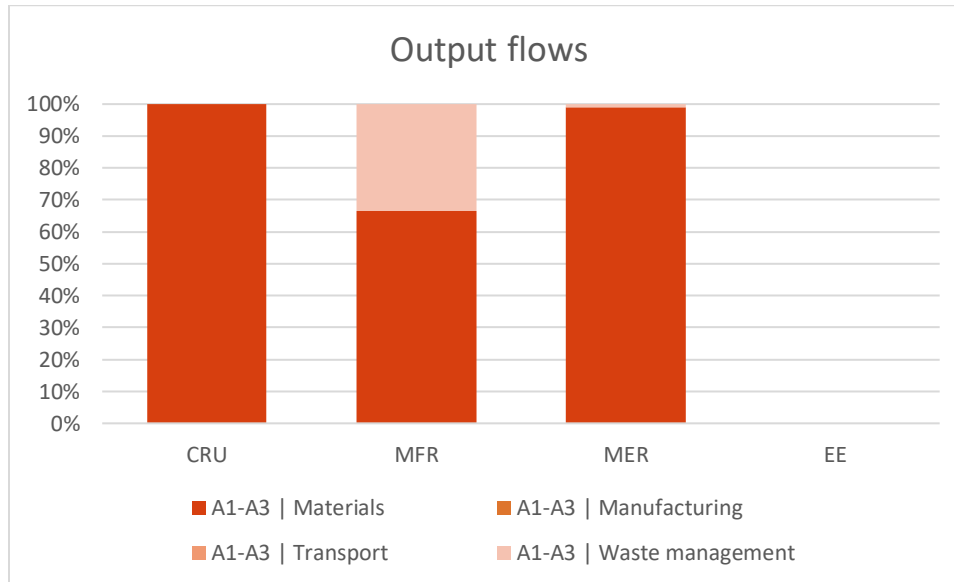
### 8.3 Contribution of the declared modules to the Waste Flow Indicators



- The Hazardous Waste Disposed (HWD) indicator does not present results according to the inventory of waste from the production process. This is because hazardous waste is managed internally as alternative fuels in the clinker Kiln, so it is not recorded as a landfill or incineration output.
- The Non-Hazardous Waste Disposed (NHWD) indicator is determined from the mixture of ordinary and non-hazardous industrial waste that is managed in a local sanitary landfill. The company has reduced the result of this indicator by implementing good internal practices for the classification and separation of waste to be used for reuse, recycling and energy recovery as presented below.

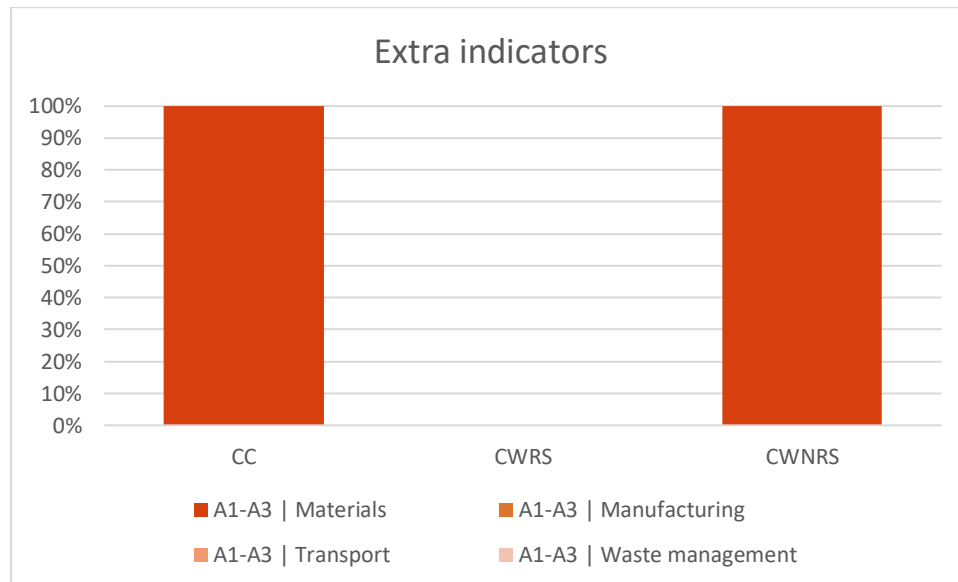


#### 8.4 Contribution of the declared modules to the Output Flow Indicators



- The Components for Re-Use (CRU) indicator is defined by the generation and separation of waste from the clinker manufacturing stage, while Materials for Recycling (MFR) considers scrap metal and other recyclable industrial waste generated on site and shows the recovery of pallets for subsequent reuse outside the production system. It is highlighted that waste treatment through recycling exceeds the NHWD indicator by 350% for bulk presentation and more than 500% for packaged presentation.
- The separation of energy recoverable waste, which is incorporated as alternative fuels in the Clinker kiln, is highlighted through the Materials for energy recovery (MER) indicator, which represents more than 350% of the result of the NHWD indicator, this being one of the good practices of the company.

## 8.5 Contribution of the declared modules to the additional indicators



- The resulting indicators show that the contribution of CO<sub>2</sub> emissions from calcination has been significantly reduced, which is explained by benefit from the formulation with a low clinker content.
- The results also show an important use of waste as an alternative fuel, such that the carbon emissions from non-renewable waste sources, Emissions from Combustion of Waste from Non-Renewable Sources (CWNRS), represent almost 15% of the emissions from calcination.
- The Emissions from Combustion of Waste from Renewable Sources (CWRS) indicator does not present results as there are no tools or references to determine the calculation of biogenic content in waste managed as an alternative secondary fuel.



## **9. ADDITIONAL INFORMATION**

### **9.1 Origin of Raw Materials**

The supply of the main raw materials for the production of cement is carried out through the extraction of materials in our quarries. The limestone is extracted in Agua Caliente de Cartago, Costa Rica where our cement production plant is located, while the Pozzolana is extracted in Llano Grande de Cartago, Costa Rica, and the high-grade limestone in Azul de Turrialba, Costa Rica, at 17 km and 45 km from our production plant, respectively, which contributes to the reduction of the environmental impacts related to the transportation of raw materials. The material extracted from these sites represents 94% of the raw materials consumed. This feature contributes to the calculation of the credit value Materials and Resources category of the LEED v4 and v4.1.

### **9.2 Air Emissions - VOC**

The Low-Emitting Materials Credit<sup>4</sup> in LEED v4 and v4.1 recognizes that plain concrete is an inherently non-emitting material, and no Volatile Organic Compounds (VOC) emission testing is required. Therefore, since cement is the basic component of concrete, it is also considered an inherently non-emitting source. To maintain this condition, without any testing for VOC emissions, it must be ensured that the concrete application does not include integral organic based surface coatings, binders or sealers.

## **10. DIFFERENCES COMPARED TO PREVIOUS VERSIONS OF THE EPD**

- This is the first version of the Holcim Fuerte Cement EPD by Holcim Costa Rica.

---

<sup>4</sup> <https://www.usgbc.org/credits/schools-new-construction-healthcare/v4/eq112>

## 11. REFERENCES

- PCR 2019:14. Construction Products, version 1.11.
- C-PCR-001 to PCR 2019: 14. Cement and building lime, version 2019-12-20
- EN 15804: 2012 + A2: 2019. Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products.
- GCCA. Industry EPD Tool for Cement and Concrete - LCA Model, International version. Version 3.0. Quantis Intl for Global Cement and Concrete Association (GCCA). 2020
- General Programme Instructions of the International EPD® System. Version 4.0.
- Costa Rican Electricity Institute. (2021). Annual Reports. Retrieved from Centro Nacional de Control de Energía: <https://apps.grupoice.com/CenceWeb/CenceDescargaArchivos.jsf?init=true&categoria=3&codigoTipoArchivo=3008>
- ISO 14025: 2006. Environmental labels and declarations - Type III environmental declarations - Principles and procedures.
- ISO 14040: 2008 - "Environmental management - Life cycle assessment - Principles and framework".
- ISO 14044: 2008 - "Environmental management - Life cycle assessment - Requirements and guidelines".
- LCA Report for Cement Products by Holcim Costa Rica. Biomatech Engineering Ltd. Costa Rica. 2021.

