CEM I 42.5R/52.5N, ASTM I/II LA (MH)

Environmental Product Declaration
for Portland Cement

Programme The International EPD® System
Programme operator EPD International AB
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In accordance with ISO 14025:2006 and 15804:2012+A2:2019/AC:2021
EPD programme website: www.environdec.com.
An EPD should provide current information and may be updated if conditions change.
The stated validity is therefore subject to the continued registration and publication at the website.

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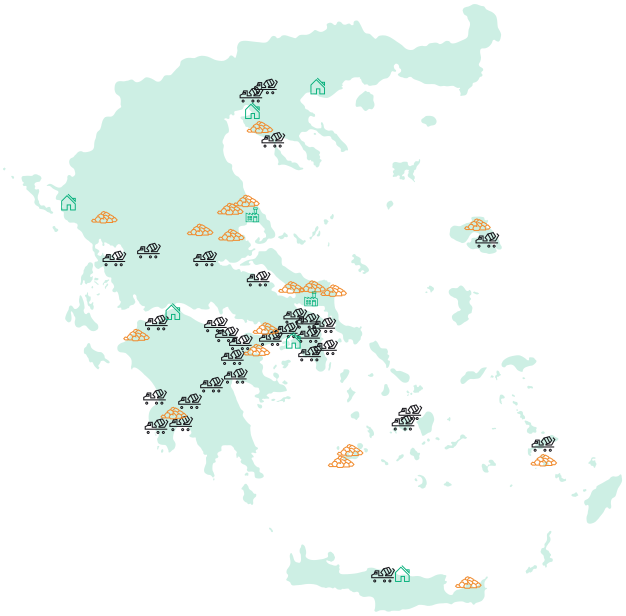
HERACLES GROUP OF COMPANIES

COMPANY INFORMATION

HERACLES Group of Companies, a member of Holcim, is the leader in cement sales in Greece, having more than 110 years of presence in the market. Having a network of 45 production and commercial facilities throughout Greece, the Company is active in the production and marketing of cement, aggregates, concrete and industrial minerals, offering products and solutions that meet the diversified needs of customers and the requirements of modern construction.

Main drivers for creating value are growth, the simplification of procedures and performance, financial strength and development of HERACLES Group people. Guided by sustainable development, the company implements effective resource management, which in combination with the organizational structure at all levels, enables to export cement, clinker, pumice, industrial materials and solid fuels, in more than 20 countries worldwide, contributing substantially to the national economy.

For HERACLES Group, Sustainable Development is a long-term commitment and non-negotiable priority that guides our daily business activity. We believe in building a greener and more sustainable world for people and the planet. A world that operates with respect for water and nature and upgrades the quality of life for all. We advocate an innovative, climate-neutral construction industry that will apply the principles of circular economy regarding the use of resources. To this end, we focus on four strategic pillars for sustainable development - Local Communities, Climate & Energy, Circular Economy, Nature - that create value for our activities, shareholders and our social partners. We are leading the transition to a lower carbon sector through the development and delivery of green products and solutions, saving natural resources, using alternative fuels and promoting circular economy.



6 Companies

2 Cement plants

20 Types of cement

10 Third Party bag depots

12 Ports

31 Ready-Mix concrete plants

4.000 Customers

18 Quarries

6 Distribution centers

30 Points of presence

PRODUCT DESCRIPTION

Cement is one of the most important building materials used in the construction industry, working as binder that sets, hardens and adheres to other materials to bind them together. It is the main raw material for the production of concrete, mortars, grouts and plasters.

This is an average EPD for Portland Cement **CEM I 42.5R, CEM I 52.5N** and **ASTM I/II LA (MH)** produced by Milaki Cement Plant of HERACLES GCCo, located near Aliveri town in Greece.

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The product's technical characteristics and composition are presented at the tables below. Product declarations and certificates can be found at the company's website www.lafarge.gr

Technical characteristics		CEM I 42.5R EN 197-1	CEM I 52.5N EN 197-1	ASTM I/II LA (MH) ASTM C150/C150M – 22
Mechanical properties	Compressive Strength 2 days (MPa)	≥ 20 (MPa)	≥ 20 (MPa)	-
	Compressive Strength 3 days	-	-	≥ 1740 (psi)
	Compressive Strength 7 days	-	-	≥ 2760 (psi)
	Compressive Strength 28 days	42,5 – 62,5 (MPa)	≥ 52,5 (MPa)	≥ 4060 (psi)
Chemical properties	Sulfate content (SO_3 % w/w)	≤ 4,0	≤ 4,0	≤ 3,0*
	Chloride content (Cl % w/w)	≤ 0,1	≤ 0,1	-
	Loss of Ignition (% w/w)	≤ 5,0	≤ 5,0	≤ 3,5
	Insoluble residue (% w/w)	≤ 5,0	≤ 5,0	≤ 1,5
	Eq.Na_2O(% w/w)	-	-	≤ 0,60
Physical properties	Initial setting time (min)	≥ 60	≥ 45	≥ 45
	Soundness (mm)	≤ 10		-

Composition (% by mass)*	
Clinker	95-100
Minor additional constituents	0-5

**Gypsum is not included in the aforementioned composition*

The LCIA results of the LCA represents the weighted average product. The GWP-GHG indicator does not differ more than 10%. The range of the LCIA results is not significant (<10%).

LCA INFORMATION

DECLARED UNIT
The declared unit is 1 tn (1.000 kg).

GOAL AND SCOPE
This EPD evaluates the environmental impacts of the production of 1 tn of average CEM I 42.5R/52.5N, ASTM I/II LA (MH) from cradle to gate.

BACKGROUND DATA
The life cycle inventory database used in the GCCA EPD Tool (v4.0) is the Ecoinvent database (v3.5) from which backround data were retrieved.

SOFTWARE
The software used for the production of the LCA results is GCCA EPD Tool (v4.0).

DATA QUALITY
ISO 14044 was applied in terms of data collection and quality requirements. The data concerning the modules A3 (product manufacturing) and A2 (transportation) were provided by HERACLES GCCo and involved all input and output materials to the plant, the consumed utilities (energy, water) and the distances and means of transport for each input stream. The background data for the module A1 e.g. electricity generation, raw materials and fuels production were recovered from Ecoinvent database (v3.5). Regarding electricity mix, guarantees of origin in combination with the latest (2021) national residual electricity mix as published in DAPEEP SA were utilized.

TIME REPRESENTIVENESS
The current EPD version has been updated with data for the entire year 2022, while the original version was based on 2020.

GEOGRAPHICAL SCOPE
Worldwide

ALLOCATIONS
Wherever possible allocation was avoided. The production was divided into two sub-processes, clinker and cement, and the related input and output data to each sub-process were collected. In some cases that data were not able to be attributed directly to the specific product production, they were allocated by physical properties (mass).

ASSUMPTIONS
The utilized truck types of GCCA EPD Tool have capacity >32t for primary and secondary materials and fuels, while for packaging 16 - 32t. The default emission standard considered for these trucks is EURO6.

CUT-OFF RULES
The cut-off rule for insufficient data or data gaps that are less than 1% of the total input mass and less than 5% of energy usage and mass per module was applied only to the grinding aid.

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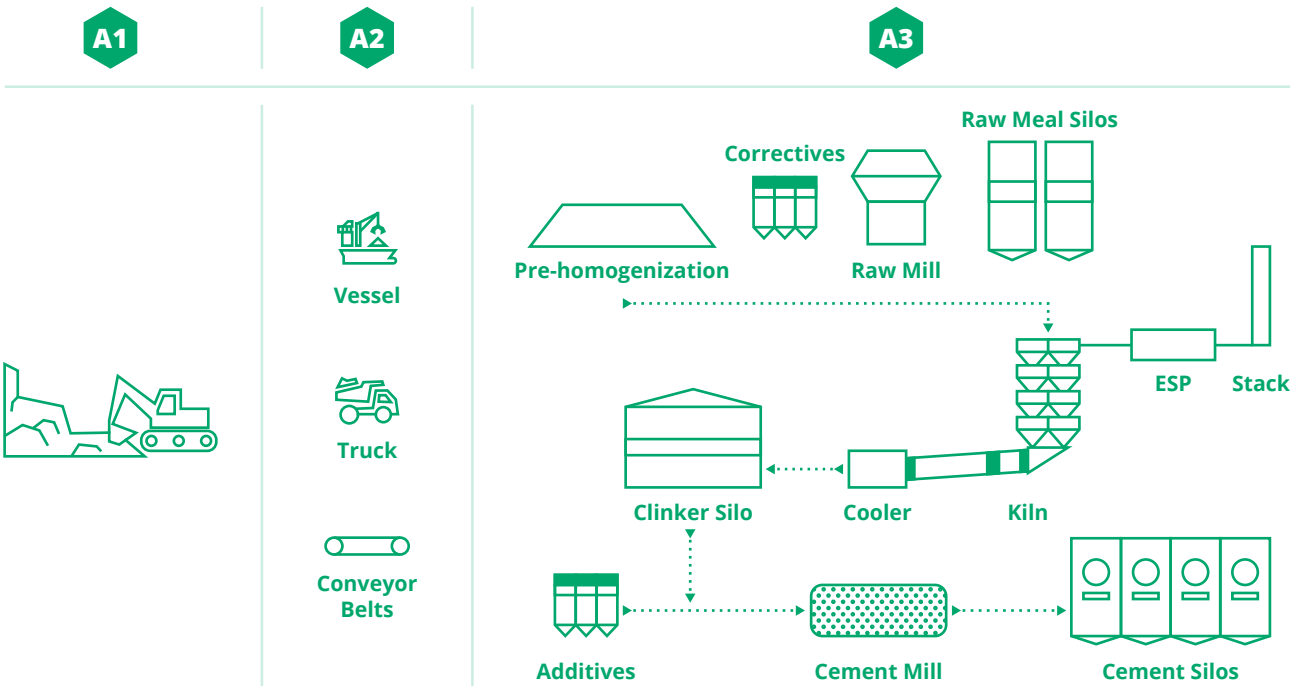
SYSTEM BOUNDARY

The scope of this study is “cradle to gate” covering the product stage (modules A1-A3), since the product fulfills the three conditions required by EN 15804:2012+A2:2019, about the exclusion of modules C1-C4 and D.
The stage included in the study is just product stage (A1-A3), since the product fulfills the three conditions required:

- the product or material is physically integrated with other products during installation so they cannot be physically separated from them at end of life.
- the product or material is no longer identifiable at end of life as a result of a physical or chemical transformation process.
- the product or material does not contain biogenic carbon.

X= Included, ND= Module Not Declared

	Product Stage			Construction Stage		Use Stage							End-of-life Stage				Resource Recovery stage
	Raw Materials Supply	Transport	Manufacturing	Transport	Construction installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction and demolition	Transport	Waste processing for reuse, recovery and/or recycling	Disposal	Reuse-Recovery-Recycling-potential
Modules	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Modules declared	X	X	X	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Geography	EU	EU	GR														
Specific data used	>90%																
Variation-products	Not relevant																
Variation-sites	Not relevant																



A1: Raw Material Supply
Production starts with raw materials supply. This stage includes the mining and processing of raw materials, the extraction and processing of fuels and the recycling of secondary materials.

A2: Transportation of raw materials to manufacturer
Transport concerns the delivery of raw materials from the supplier to the gate of the manufacturing plant. Raw materials are transported by truck, vessels and conveyor belts from nearby quarries.

A3: Manufacturing
The cement manufacturing starts with the formation of a raw materials homogeneous stockpile that has the right proportion of calcium oxide, alumina, silica and iron oxide. This stockpile is called pre-blending and contains mainly limestone and clay with additional materials in smaller proportions like fluoride, bauxite and hornstone. The stockpile is reclaimed, regularly analyzed and adjusted by correctives addition to fulfill the raw mix design requirements in terms of chemistry. Then, it is fed to the raw mill for grinding where a fine powder, called raw meal, is produced. The raw meal is stored into silos where further homogenization takes place and then fed to the rotary kiln for sintering where the temperature rises at around 1450°C by fuels burning and clinkerization reactions take place. At the end of the kiln, the sintered material is rapidly cooled and clinker is formed. Finally, cement is produced in the cement mills where clinker is ground with gypsum and certain natural or artificial materials and then stored into silos.

ENVIRONMENTAL PERFORMANCE

ENVIRONMENTAL IMPACTS per 1 ton average CEM I 42.5R/I 52.5N, ASTM I/II LA (MH)		Unit	A1-A3
GWP-total	**Global warming potential - total**	kg CO_2 eq	7,70E+02
GWP-fossil	**Global warming potential - fossil**	kg CO_2 eq	7,70E+02
GWP-biogenic	**Global warming potential - biogenic**	kg CO_2 eq	2,07E-01
GWP-luluc	**Global warming potential - luluc**	kg CO_2 eq	1,78E-01
GWP-GHG[1]	**Global warming potential - GHG**	kg CO_2 eq	7,70E+02
ODP	**Ozone Depletion Potential**	kg CFC-11 eq	1,49E-05
AP	**Acidification Potential**	mol H^+ eq	1,40E+00
EP-freshwater	**Eutrophication potential - freshwater**	kg P eq	1,65E-02
EP-marine	**Eutrophication potential - marine**	kg N eq	1,29E-03
EP-terrestrial	**Eutrophication potential - terrestrial**	mol N eq	5,21E+00
POCP	**Photochemical oxidant formation Potential**	kg NMVOC eq	1,34E+00
ADPe[2]	**Abiotic depletion potential - non fossil resources**	kg Sb eq	1,49E-04
ADPf[2]	**Abiotic depletion potential - fossil resources**	MJ	3,71E+03
WDP[2]	**Water deprivation potential**	m^3 eq	4,62E+01

[1] This indicator accounts for all greenhouse gases except biogenic carbon dioxide uptake and emissions and biogenic carbon stored in the product. As such, the indicator is identical to GWP-total except that the CF for biogenic CO_2 is set to zero.
[2] The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experience with the indicator.

RESOURCE USE per 1 ton average CEM I 42.5R/I 52.5N, ASTM I/II LA (MH)		Unit	A1-A3
PERE	**Use of renewable primary energy excluding renewable primary energy resources used as raw materials**	MJ	3,01E+02
PERM	**Use of renewable primary energy resources used as raw materials**	MJ	0,00E+00
PERT	**Total use of renewable primary energy resources**	MJ	3,01E+02
PENRE	**Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials**	MJ	3,70E+03
PENRM	**Use of non-renewable primary energy resources used as raw materials**	MJ	3,87E+00
PENRT	**Total use of non-renewable primary energy resources**	MJ	3,71E+03
SM	**Use of secondary material**	kg	5,67E+01
RSF	**Use of renewable secondary fuels**	MJ	3,04E+02
NRSF	**Use of non-renewable secondary fuels**	MJ	9,38E+01
FW	**Use of net fresh water**	m^3	1,13E+00

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OUTPUT FLOWS AND WASTE CATEGORIES per 1 ton average CEM I 42.5R/I 52.5N, ASTM I/II LA (MH)		Unit	A1-A3
HWD	Hazardous waste disposed	kg	0,00E+00
NHWD	Non-hazardous waste disposed	kg	0,00E+00
RWD	Radioactive waste disposed	kg	0,00E+00
CRU	Components for re-use	kg	0,00E+00
MFR	Materials for recycling	kg	6,92E-01
MER	Materials for energy recovery	kg	0,00E+00
EE	Exported energy	MJ	0,00E+00

The indicated GWP values do not include the greenhouse gas emissions from the incineration of waste fuels at clinker production since according to EN 15804 processes of waste processing shall be assigned to the product system that generates the waste until the end-of-waste state is reached.

ADDITIONAL INFORMATION

HERACLES GCCo hereby declares that all cement products are in compliance with the REACH Regulation (EC) No 1907/2006, concerning the Registration, Evaluation, Authorization and Restriction of Chemicals. Cement does not contain any Substances of Very High Concern (SVHC) currently on the candidate list. REACH SVHC list is not static and is updated frequently thus the company will continue to evaluate, research and review to fulfil the demands of the regulation. More information about cement safety handling is available at the Safety Data Sheet (SDS) published at the company's website www.lafarge.gr

The EPD does not give information on release of dangerous substances to soil, water and indoor air because the horizontal standards on measurement of release of regulated dangerous substances from construction products using harmonised test methods according to the provisions of the respective technical committees for European product standards are not available.

REVISION DETAILS

Revision 2023-07-21: This version includes updated LCA information based on the full year 2022, whereas the original version was based on 2020 data. For the EPD development GPI v.4.0 and PCR 2019:14 v.1.2.5. have been followed. The incentive for the new LCA was the optimization of the production process, resulting in improved environmental impact indicators. The main reasons for the impact minimization were the substitution increase of conventional fuels by alternative and the improvement of the cement recipe. In addition, the company information section has been updated since there have been important changes.

REFERENCES

- **GPI v.4.0:2021-03-29** General Programme Instructions of the International EPD® System
- **PCR 2019:14 v.1.2.5** Product Category rules | Construction products | The International EPD® System
- **EN 15804:2012+A2:2019/AC:2021** Sustainability of construction works - Environmental Product Declarations - Core rules for the product category of construction products
- **c-PCR-001** Cement and building lime (EN 16908:2017+A1:2022) | The International EPD® System
- **EN 16908:2017+A1:2022** Cement and building lime - Environmental product declarations - Product category rules complementary to EN 15804
- **EN 197-1:2011** Cement Composition, specifications and conformity criteria for common cements
- **ASTM C150/C150M** – 22 Standard Specification For Portland Cement
- **ISO 14020:2000** Environmental labels and declarations - General principles
- **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
- **Ecoinvent Centre**| www.Eco-invent.org
- **DAPEEP SA:** Renewable Energy Sources Operator & Guarantees of Origin | Greece | www.dapeep.gr

HERACLES GROUP OF COMPANIES

CONTACT INFORMATION

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Programme operator	EPD® THE INTERNATIONAL EPD® SYSTEM	Valhallavägen 81, 114 27 Stockholm, Sweden email: info@environdec.com www.environdec.com

PROGRAMME-RELATED INFORMATION

Accountabilities for PCR, LCA and third-party verification

Product Category Rules (PCR)

ISO standard ISO 21930 and CEN standard EN 15804 serve as the core Product Category Rules (PCR)

Product Category Rules (PCR):
PCR 2019:14 Construction products, version 1.2.5
c-PCR-001 Cement and Building Lime (EN 16908:2017+A1:2022) 2022-05-18

PCR review was conducted by: The Technical Committee of the International EPD® System.
See www.environdec.com/TC for a list of members. Review chair: Claudia A. Peña, University of Concepción, Chile. The review panel may be contacted via the Secretariat www.environdec.com/contact

Life Cycle Assessment (LCA)

LCA Accountability: HERACLES GENERAL CEMENT COMPANY S.A.

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Third party verification

Independent third-party verification of the declaration and data, according to ISO 14025:2006, via:
☒ EPD verification by accredited certification body
Third party verification: EUROCERT S.A.

EURO CERT

Chlois 89, Athina 144 52, Greece
email: info@eurocert.gr
www.eurocert.gr

EUROCERT S.A. is an approved certification body accountable for third-party verification
The certification body is accredited by: Hellenic Accreditation System SA (E.S.Y.D), Accreditation No. 21-8

Procedure for follow-up during EPD validity involves third party verifier
☒ Yes ☐ No

The EPD owner has the sole ownership, liability, and responsibility of the EPD.
EPDs within the same product category but registered in different EPD programmes may not be comparable. For two EPDs to be comparable, they must be based on the same PCR (including the same version number) or be based on fully-aligned PCRs or versions of PCRs; cover products with identical functions, technical performances and use (e.g. identical declared/functional units); have equivalent system boundaries and descriptions of data; apply equivalent data quality requirements, methods of data collection, and allocation methods; apply identical cut-off rules and impact assessment methods (including the same version of characterization factors); have equivalent content declarations; and be valid at the time of comparison. For further information about comparability, see EN 15804 and ISO 14025.

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