DAPHABITAT SYSTEM ENVIRONMENTAL PRODUCT DECLARATION

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[in accordance with **ISO 14025, EN 15804:2012+A2:2019 and EN 15942**]

Declaration number: **DAP 001:2024**

PORTLAND CLINKER MACEIRA-LIZ PLANT

Issue date: **25/03/2024** Expiry date: **24/03/2029**

SECIL – Companhia Geral de Cal e Cimento, S.A.

Version 1.4.1 Ed. March 2024

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1. GENERAL INFORMATION

1.1. The DAPHabitat System

Identification of the programme operator:	Platform for Sustainable Construction Association www.clusterhabitat.pt geral@clusterhabitat.pt
Address:	Departamento Engenharia Civil Universidade de Aveiro 3810-193 Aveiro
Email address:	deptecnico@clusterhabitat.pt
Telephone number:	(+351) 234 401 576
Website:	www.daphabitat.pt
Logo:	

1.2. EPD Owner

Owner's name:	SECIL – Companhia Geral de Cal e Cimento, S.A.
Address (production site):	Rua da Sismaria, 16, Zona Industrial 2415-809 Marrazes
Address (head office):	Fábrica Maceira-Liz 2405-019, Maceira-Leiria
Telephone number:	(+351) 217 927 100
Email address:	apoiotecnico@secil.pt
Website:	https://www.secil.pt/
Logo:	
Information on management systems in place:	NP EN ISO 9001 – Quality Management System NP ISO 14001 – Environmental Management System ISO 45001 – Health and Safety Management System EMAS | Eco-Management Audit Scheme
Specific aspects of production:	CAE (economic activity code) 23510 – Manufacture of cement
Organisation's environmental policy:	Commitments made by SECIL as part of its Environmental Responsibility and Protection policy: • To ensure a responsible performance standard that makes using natural resources compatible with the maintenance and development of the ecosystems in which the company operates. • To mitigate the impacts of its actions, through the adoption of the best technologies and best practices available and the appropriate training of its employees. • To promote biodiversity in the territories under its management. To reduce the carbon impact of its activity, including by promoting the use of secondary raw materials and alternative fuels. To provide the public with regular data on its environmental performance.

1.3. Information concerning the EPD

Authors:	Paula Quinteiro Secil - Companhia Geral de Cal e Cimento, S.A.
Authors' contact:	Address: Universidade de Aveiro, Campus Universitário de Santiago, 3810-193 Aveiro, Portugal Telephone: 234 370 200 E-mail: p.sofia@ua.pt Address: Estrada do Outão s/n, 2901-864 Setúbal, Portugal E-mail: info.pssg@secil.pt
Issue date:	25/03/2024
Registration date:	12/04/2024
Registration number:	DAP 001:2024
Valid until:	24/03/2029
Representativeness of the EPD (location, product, group of producers):	EDP of one (1) product class, produced in one (1) industrial unit, belonging to one (1) single producer (Secil - Companhia Geral de Cal e Cimento, S.A.)
Where to find product information:	https://www.secil.pt
EPD type	Cradle-to-gate EPD (A1-A3)

1.4. Demonstration of the verification

Independent external verification in accordance with the NP ISO 14025:2010 and EN 15804:2012+A2:2019 standards	
Certification Body	Verifier(s)
(CERTIF – Associação para a Certificação)	(Marisa Almeida | José Dinis Silvestre)

1.5. EPD Registration

Registration Programme Operator
(Platform for Sustainable Construction)

1.6. PCR (product category rules) basic model

Name:	Base PCR model for construction products and services
Issue date:	Edition August 2023
Database registration number:	RCP-mb001
Version:	Version 2.3
Identification and contact details of the coordinator(s):	Marisa Almeida | marisa@ctcv.pt Luís Arroja | arroja@ua.pt José Dinis Silvestre | jose.silvestre@ist.utl.pt
Identification and contact details of the authors:	Marisa Almeida | marisa@ctcv.pt Luís Arroja | arroja@ua.pt José Silvestre | jds@civil.ist.utl.pt Fausto Freire Cristina Rocha Ana Paula Duarte Ana Cláudia Dias Helena Gervásio Victor Ferreira Ricardo Mateus António Baio Dias
Composition of the sector panel:	-
Consultation period:	18/11/2015 - 18/01/2016
Valid until:	01/06/2027

The CEN EN 15804 standard serves as the basic product category rules (PCR).

1.7. Relevant c-PCR (Complementary product category rules)

Name:	EN 16908:2017+A1:2022 - Cement and building lime - Environmental product declarations - Product category rules complementary to EN 15804
Issue date:	March 2022
Database registration number:	EN 16908:2017+A1:2022
Version:	EN 16908:2017+A1, March 2022
Identification and contact details of the coordinator(s):	European Committee for Standardisation (CEN)
Identification and contact details of the authors:	-
Composition of the sector panel:	-
Consultation period:	-
Valid until:	-

1.8. Information concerning the product/product class

<table>
<tr><td>Product name:</td><td>Clinker for Portland cement, or Portland clinker in short.</td></tr>
<tr><td>Product illustration:</td><td>  </td></tr>
<tr><td>Brief description of the product:</td><td>The main raw materials used to produce Portland clinker are marl or clay and limestone, which are extracted in quarries. Mining is carried out above ground, on plateaus, starting at the highest level. The natural raw materials and secondary materials (e.g. correction materials) are crushed, dosed and subjected to firing in which the physical-chemical reactions (calcination) of the clinker process take place, to obtain Portland clinker. Portland clinker is a fine granular material used as a binder in cement.
The clinker does not contain any substance included on the Candidate List of Substances of Very High Concern (SVHC) above the limit for registration with the European Chemicals Agency, i.e. above 0.1 per cent (m/m).</td></tr>
<tr><td>Main technical characteristics of the product:</td><td>Table 1: Technical characteristics and physical properties of Portland clinker.
<table>
<tr><th>Designation</th><th>Units</th><th>Portland Clinker</th></tr>
<tr><td>Density</td><td>g/cm³</td><td>Apparent 0.90 to 1.80</td></tr>
<tr><td>Solubility in water (T - 200C)</td><td>g/l</td><td>Mild (0.1 - 1.5)</td></tr>
<tr><td>pH (T = 200C; in water, water-solid ratio 1:2)</td><td>-</td><td>11.0 - 13.5</td></tr>
<tr><td>Melting point</td><td>0C</td><td>Greater than 1250</td></tr>
<tr><td>Odour; Odour threshold</td><td>-</td><td>No odour threshold; odourless</td></tr>
</table></td></tr>
<tr><td>Description of the application/use of the product:</td><td>For the production of Portland cement and other hydraulic binders</td></tr>
<tr><td>Placing on the market/Rules for application on the market/Technical product standards:</td><td>NP EN 197-1: Composition, specifications and conformity criteria for Ordinary cements</td></tr>
<tr><td>Quality control:</td><td>Not applicable</td></tr>
<tr><td>Special delivery conditions:</td><td>Not applicable</td></tr>
<tr><td>Components and substances to declare:</td><td>Not applicable</td></tr>
<tr><td>Information where explanatory documents can be obtained:</td><td>Portland clinker is an intermediate material for physical integration into cement that is not available for sale to the general public.
For detailed information on the product, please contact SECIL at info.pssg@secil.pt.</td></tr>
<tr><td>History of LCA studies:</td><td>-</td></tr>
</table>

1.9. Calculation rules of the LCA

Functional unit:	Not applicable
Declared unit:	1,000 kg of Portland clinker
System boundary:	The system evaluated includes the A1-A3 module (product stage). A more detailed description of the system boundary is given in Section 2.1.
Exclusion criteria:	The LCA took into account the extraction and processing of natural raw materials, the transport of secondary raw materials (including waste from other industries), the production of auxiliary materials and the energy consumed in the manufacture of clinker. Likewise, the waste management processes generated in the production of clinker (until the end of waste status is reached) for which inventory data is available were considered. Bag filters, the refractory lining of rotary kilns, lubricating oils, acetylene used in maintenance operations (welding), sodium hypochlorite and sodium hydroxide used to treat the water used in cooling towers were excluded from the system boundary, which individually correspond to a mass of less than 1% of the total mass of inputs, and as a whole correspond

	to a mass of less than 5% of the total mass of inputs in module A1-A3. They are therefore covered by the exclusion criteria defined in EN 16908:2017+A1 - Cement and building lime - Environmental product declarations - Product category rules, namely their mass is less than 1% of the total mass of the inputs and does not exceed 5% of the total mass of the inputs of each module. The LCA for Portland clinker also excluded energy and water consumption in the administrative areas, as well as the production of wastewater and waste from these areas. In addition, environmental loads associated with the construction and maintenance of infrastructure and equipment (capital goods) were excluded.
Assumptions and limitations:	The results of the environmental impacts and other indicators presented in this EPD refer to the year 2021.
Quality and other characteristics of the information used in the LCA:	The quality of the inventory data was assessed taking into account the criteria of the PEF (Product Environmental Footprint) category rules (section 5.6 of the guide, Menfredi et al., 2012), as indicated in table E.2 (Data quality and criteria from the Product Environmental Footprint Category Rules) of EN 15804:2012+A2:2019+AC and in the guide to the software used, the GCCA EPD Tool for Cement and Concrete (V 4.0), and based on the recommendations of the PCR documents - Base Model. The quality of the data was broadly classified between reasonable and good on a 5-level qualitative scale from very bad to very good, in line with the data quality requirements - temporal, geographical and technological. The information on the production of Portland clinker is less than 5 years old, using mostly primary data collected directly from SECIL - Maceira - Liz. Plant For the operations associated with the Portland clinker manufacturing process, real data specific to the production unit was used. The information for background processes not provided by SECIL, and over which SECIL has no influence, was obtained from generic data in the Ecoinvent database v3.5. These were selected to provide geographical and technological coverage that fulfils the data quality criteria stipulated in Annex E of EN 15804:2012+A2:2019. Electricity production was modelled in the GCCA with information obtained from SECIL's electricity producer and supplier.
Allocation rules:	In addition to clinker production, bypass dust (by-product) is also produced, some of which is sold and some of which is consumed internally. To determine the inputs and outputs associated only with the production of clinker, the procedure for subdividing the unit process was first adopted. Thus, only the operations associated with the production of the product being analysed were taken into account, and operations exclusive to other products were excluded. Then, for the operations included, an allocation procedure was applied based on the mass of the different products produced. The Portland clinker production process also involves multifunctionality associated with the consumption of waste from other industries as secondary raw materials (e.g. shellac and glaze, used refractories, boiler bottom ash, etc.) and secondary fuels (fuels derived from waste, used tyre chips, etc.), so the environmental impacts associated with these raw materials and fuels only concern the operations that take place from their transport to the Maceira-LIZ plant. On the other hand, waste is produced that will later be recovered, for which further processing has been considered up to the point at which it is expected to reach end-of-waste status.
Software used for evaluation:	GCCA EPD Tool for Cement and Concrete (V 4.0), International version.
Background database used for the LCA:	Ecoinvent database version 3.5 published in December 2018; cut-off approach.
Variability of the results of LCIA	The composition of raw materials can also slightly affect the results of the LCIA. The mix of fuels in the clinker kiln shows a variability of less than 10 per cent in the LCIA results.
Comparability of construction products' EPD:	EPD for construction products and services may not be comparable if they are not produced following EN 15804 and EN 15942 and following the comparability conditions determined by ISO 14025.

1.10. Use of average environmental performance

Not applicable

1.11. Technical information for Reference Service Life (RSL)

Not applicable

1.12. Flow diagram of input and output of the processes

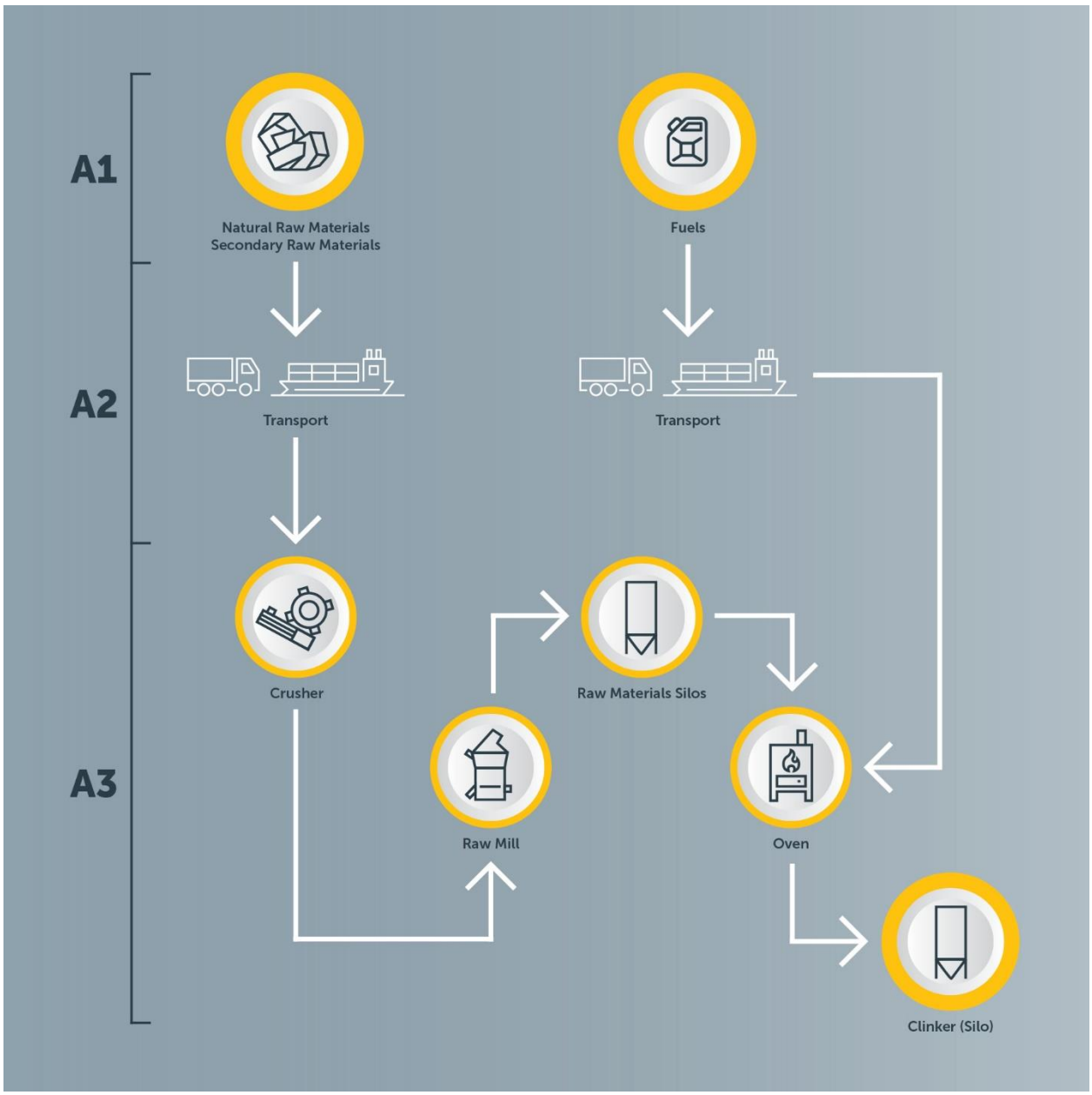

Figure 1: Flowchart of the Portland clinker manufacturing process.

2. CORE ENVIRONMENTAL IMPACT INDICATORS

2.1. Description of the system boundaries

(✓= included; ND = module not declared)

PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				ENVIRONMENTAL BENEFITS AND BURDENS BEYOND THE SYSTEM BOUNDARY
Supply of raw materials	Transportation	Manufacturing	Transportation	Construction and installation process	Use	Maintenance	Repairing	Replacement	Rehabilitation	Operational energy use	Operational water use	Deconstruction and demolition	Transportation	Waste processing	Disposal	Reuse, recovery, potential recycling
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
✓	✓	✓	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

The A1-A3 module (product stage) of Portland clinker takes into account the extraction and processing of primary (natural) raw materials, the production of secondary raw materials, the transport of raw materials, additives, fuels and electricity to the production unit, the manufacture of Portland clinker, as well as the processing of waste up to the end of its waste status or its final destination.

The raw material then enters the kiln, moving along the kiln due to its rotation and slight inclination, continuing to heat up and carrying out the physical-chemical reactions of the clinker process at a temperature of up to 1450ºC, to ultimately obtain clinker. As firing is an energy-intensive stage, primary fuels are used, i.e. fossil fuels, as well as secondary fuels (fuels derived from waste, e.g. used tyres, fluff and fuels derived from waste).

The main raw materials used to produce Portland clinker are marl or clay and limestone, which are extracted in quarries. Mining is carried out above ground, on plateaus, starting at the highest level.

Once the materials are extracted, they are in the form of blocks measuring up to $1m^3$, so it is necessary to reduce their size to a dimension compatible with the transportation, storage and supply of the subsequent manufacturing phases; this operation is performed in the crusher. After crushing, the natural raw materials are stored, which is combined with a pre-homogenisation function so that the various uniform stockpiles.

This is followed by raw milling, in which the natural and secondary raw materials (materials derived from waste, e.g. foundry sands, ceramic shards, calcium carbonate sludge, construction and demolition waste, used refractory bricks) are subjected to a drying, milling and homogenising process. Once the proportion of raw materials has been defined, they are transported to mills where the "flour" or “raw” material is produced, i.e. a finely ground mixture, in well-defined proportions, of all the natural and secondary raw materials. At this stage, the raw material is dried using the heat contained in the exhaust gases from the rotary kilns.

This is followed by the preheating stage in which the raw material is extracted from the storage silos and fed into the preheating system (cyclone tower), where it is heated by the exhaust gases resulting from the burning of the fuels in the rotary kiln.

From 1450ºC onwards, the clinker begins to cool, still inside the kiln, and is completed in the cooler, where counter-current air is introduced, using this heated air as secondary firing air. In this way, there is a partial recovery of the clinker's thermal content to reduce energy

consumption in the kilns. Particle matter emissions are controlled by dedusting systems and gas emissions into the air by automated control systems for driving the furnaces. The firing phase produces a powder that comes from a bypass of the gaseous effluent to remove chlorides from the raw material and fuels, which are then treated by a bag filter. This bypass powder is a by-product, partly sold and partly consumed internally in cement production (used as a component in cement mills).

Finally, the clinker is stored for later use in the production of ordinary cement or other hydraulic binders. The transport of clinker to the mills or for sale is carried out with bag filters to minimise diffuse dust emissions.

The LCA took into account the consumption of electricity, gases and lubricating oils, as well as internal movements in transport screens, for example, the transport of crushed natural materials to the warehouse.

Portland clinker is produced 'dry', meaning that very little water is used during the production process. However, water is consumed through evaporation in the cooling towers of the gases that go to the clinker kiln's bag filter. This water comes from our boreholes and requires treatment with sodium hypochlorite and sodium chloride.

The diesel used for internal movements at Secil comes from a diesel refuelling station at the plant. Pollutant emissions to rainwater from the hydrocarbon separators associated with the diesel refuelling station and the collection of oily water throughout the plant were therefore taken into account. The diesel consumption of emergency generators was also taken into account to guarantee the normal operation of clinker production processes in the event of a temporary power cut.

The transport and treatment of waste resulting from the clinker production process, such as waste containing hydrocarbons, was considered.

2.1.1. Justification for exemption of C1, C2, C3, C4 and D modules from declaration

Portland clinker, being an intermediate product, fulfils all the conditions required by EN 15804:2012+A2:2019+AC and EN 16908:2017+A1, to consider the cradle-to-gate life cycle (A1-A3), namely:

- clinker is physically integrated into cement, which does not allow the physical separation of clinker and cement at the end of its life;
- the physical and chemical transformation process that clinker undergoes throughout its life cycle means that at the end of its life this material is not identifiable;
- the clinker does not contain biogenic carbon.

2.2. Core environmental impact indicators

	Global warming potential total; GWP-total	Global warming potential fossil; GWP-fossil	Global warming potential biogenic; GWP-biogenic	Global warming potential land use and land use change; GWP-luluc	Depletion potential of the stratospheric ozone layer; ODP	Acidification potential; AP
Unit	kg CO_2 eq.	kg CO_2 eq.	kg CO_2 eq.	kg CO_2 eq.	kg CFC 11 eq.	mol H^+ eq.
A1-A3 Module	8,29E+02	8,29E+02	4,51E-02	4,76E-02	1,25-05	1,83E+00

KEY:

Product Stage

Units expressed per declared unit (1000 kg Portland clinker).

	Eutrophication potential aquatic freshwater; EP-freshwater	Eutrophication potential aquatic marine; EP-marine	Eutrophication potential terrestrial; EP-terrestrial	Formation potential of tropospheric ozone; POCP	Abiotic depletion potential for non-fossil resources ADP-minerals&metals	Abiotic depletion potential for fossil resources potential ADP-fossil	Water (user) deprivation potential; WDP
Unit	kg P eq.	kg N eq.	mol N eq.	Kg COVNM eq.	kg Sb eq.	MJ, P.C.I	m^3 World eq. deprived
A1-A3 Module	1,60E-02	1,13E-03	6,45E+00	1,55E+00	1,26E-04	2,62E+03	1,50E+01

KEY:

Product Stage

Units expressed per declared unit (1000 kg Portland clinker).

The results obtained for the indicators "Non-fossil Abiotic Depletion Potential (ADP-minerals&metals)", "Fossil Abiotic Depletion Potential (ADP-fossil)" and "Water Deprivation Potential (user) (WDP)" should be used with caution as the uncertainties associated with them are high or there is little experience with the indicator.

2.3. Additional environmental impact indicators

	Potential incidence of disease due to PM emissions PM	Potential Human exposure efficiency relative to U235 IRP	Potential Comparative Toxic Unit for ecosystems ETP-fw	Potential Comparative Toxic Unit for humans, cancer effects HTP-c	Potential Comparative Toxic Unit for humans, not cancer effects HTP-nc	Potential soil quality index SQP
Unit	Disease incidence	kBq U 235 eq.	CTUe	CTUh	CTUh	-
A1-A3 Module	4,33E-05	5,27E+03	7,52E+01	1,40E-06	4,25E-05	1,49E+03

KEY:

Product Stage

Units expressed per declared unit (1000 kg Portland clinker).

The impact indicator "Potential Human Exposure Efficiency in relation to U235 (IRP)" focuses mainly on the possible impact of a low dose of ionising radiation on human health resulting from the nuclear fuel cycle. It does not take into account effects resulting from possible nuclear accidents, occupational exposure or the disposal of radioactive waste in underground installations. Potential ionising radiation from soil, radon and some building materials is also not measured by this indicator.
The results obtained for the indicators "Potential Comparative Toxic Unit for Ecosystems (ETP-fw)", "Potential Comparative Human Toxicity Unit, Carcinogenic (HTP-c)", "Potential Comparative Human Toxicity Unit, Non-Carcinogenic (HTP-nc)" and "Soil Quality Potential Index (SQP)" should be used with caution as the uncertainties associated with them are high or there is little experience with the indicator.

2.4. Indicators describing the utilisation of resources

	Primary energy					
	EPR	RR	TRR	EPNR	RNR	TRNR
Unit	MJ, P.C.I	MJ, P.C.I	MJ, P.C.I	MJ, P.C.I	MJ, P.C.I	MJ, P.C.I
A1-A3 Module	1,84E+02	0,00E+00	1,84E+02	2,52E+03	0,00E+00	2,52E+03

KEY:

Product Stage

Units expressed per declared unit (1000 kg Portland clinker).

EPR = use of renewable primary energy excluding renewable primary energy resources used as raw materials; RR = use of renewable primary energy resources used as raw materials; TRR = total use of renewable primary energy resources (EPR + RR); EPNR = use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; RNR = use of non-renewable primary energy resources used as raw materials; TRNR = total use of non-renewable primary energy resources (EPRN + RNR)

	Secondary material and fuel, and water use			
	MS	CSR	CSNR	Utilising the net value of fresh water
Unit	kg	MJ, P.C.I	MJ, P.C.I	m^3
A1-A3 Module	1,18E+02	6,18E+02	8,14E+02	2,95E-01

KEY:

Product Stage

Units expressed per declared unit (1000 kg Portland clinker).

MS = use of secondary material; CSR = use of renewable secondary fuels; CSNR = use of non-renewable secondary fuels; Fresh water = use of the net value of fresh water.

2.5. Other environmental information describing different waste categories

	Hazardous waste disposed	Non-hazardous waste disposed	Radioactive waste disposed
Unit	kg	kg	kg
A1-A3 Module	5,66E-01	1,06E-02	0,00+00

KEY:

Product Stage

Units expressed per declared unit (1000 kg Portland clinker).

The characteristics that make waste hazardous are described in the applicable legislation in force, for example in the European Waste Framework Directive.

2.6. Environmental information describing output flows

	Components for reuse	Materials for recycling	Materials for energy recovery	Exported energy
Unit	kg	kg	kg	MJ
Modules A1-A3	0,00E+00	1,03E+00	4,07E-01	0,00E+00

KEY:

Product Stage

Units expressed per declared unit (1000 kg Portland clinker).

The characteristics that make waste hazardous are described in the applicable legislation in force, for example in the European Waste Framework Directive.

2.7. Information describing the biogenic carbon content at the fcatory gate

Biogenic carbon content*	Units**	Modules A1-A3 (results)
Biogenic carbon content in the product	Kg C	Not applicable
Biogenic carbon content in the packaging	Kg C	Not applicable

* 1 kg of biogenic carbon is equivalent to 44/12 kg of CO2

** This information may be omitted when the biogenic carbon content of the product or its packaging is less than 5 per cent of the mass of the product or its packaging.

3. REFERENCES

- ✓ GCCA (2023). GCCA Industry EPD Tool for cement and concrete (V4.0). Global Cement and Concrete Association (GCCA) Quantis, Switzerland;
- ✓ **DAPHabitat System General Instructions**, Version 2.1, August 2023 (at www.daphabitat.pt);
- ✓ **PCR - Base Model. Construction products and services. Following EN 15804:2012+A2:2019. DAPHabitat System.** Version 2.3, August 2023 (at www.daphabitat.pt);
- ✓ **NP ISO 14025:2009** Environmental labelling and declarations - Type III environmental declarations - Principles and procedures;
- ✓ **EN 15804:2012+A2:2019+AC** Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products;
- ✓ EN 16908:2017+A1 - Cement and building lime - Environmental product declarations - Product category rules complementary to EN 15804 European Committee for Standardisation;
- ✓ **EN 15942:2021** Sustainability of construction works – Environmental product declarations – Communication format business-to-business;
- ✓ Manfredi S., Allacker K., Chomkhamsri K., Pelletier N., Maia de Souza D. (2012). Product Environmental Footprint (PEF) Guide. European Commission (EC), Joint Research Centre (JRC), Ispra, Italy;
- ✓ Secil (2023). Secil CO_2 Manual. Monitoring, calculating and reporting CO_2 emissions. Period 2021-2025. Version 06.