DAPHabitat System

Environmental Product Declaration

www.daphabitat.pt

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

Registration number: **EPD 013:2024**

OUTÃO PORTLAND CLINKER

Issue date: **15/11/2024** Expiry date: **14/11/2029**

SECIL - COMPANHIA GERAL DE CAL E CIMENTO, S.A.

Cluster Habitat Sustentável

Version 1.4.1 Ed. March 2024

Contents

1. GENERAL INFORMATION

1.1. DAPHabitat registration system

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

1.2. EPD Owner

Name of the owner:	SECIL - Companhia Geral de Cal e Cimento, S.A.
Address (production site):	Outão Plant 2901-864 Setúbal
Address (head office):	Estrada do Outão s/n, 2901-864 Setúbal
Telephone number:	(+351) 217 927 100
Email address:	apoiotecnico@secil.pt
Website:	https://www.secil.pt/
Logo:	
Information concerning the applicable management systems:	NP EN ISO 9001 - Quality Management System NP ISO 14001 - Environmental Management System ISO 45001 - Health and Safety Management System and Health EMAS | Eco-Management Audit Scheme
Specific aspects regarding production:	CAE (economic activity code) 23510 - Manufacture of cement
Organization´s environmental policy:	Commitments made by SECIL as part of its Environmental Responsibility and Protection policy: • To ensure a responsible performance standard that makes the use of 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.
Contact of the authors:	Address: University of Aveiro, Santiago Campus, 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:	15/11/2024
Registration date:	22/11/2024
Registration number:	EPD 013:2024
Valid until:	14/11/2029
Representativeness of the EPD (location, product, group of producers):	EPD 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/
Type of EPD	Cradle-to-gate EPD (A1-A3)

1.4. Verification Statement

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. Registration of the EPD

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 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. 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
Number of registration on the database:	EN 16908:2017+A1:2022
Version:	EN 16908:2017+A1, March 2022
Identification and contact of the coordinator(s):	European Committee for Standardisation (CEN)
Identification and contact of the authors:	-
Composition of the sector panel:	-
Consultation period:	-
Valid until:	-

1.8. Product information/product class

<table>
<tr><td>Identification of the product:</td><td>Clinker for Portland cement or Portland clinker for 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 and limestone, which are extracted in quarries. Mining is carried out above ground, on plateaus, starting at the highest level. In line with good environmental practice, the quarry's paths are watered to minimise the effect of dust during the exploration phase and the landscape recovery of the floors that have already been explored is guaranteed, under the approved Environmental and Landscape Recovery Plan.
The natural raw materials and secondary materials (e.g. correction materials) are ground, 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>ºC</td><td>Greater than 1250</td></tr>
<tr><td>Odour; Odour threshold</td><td>-</td><td>Odourless; No threshold</td></tr>
</table></td></tr>
<tr><td>Description of the application/use of the product:</td><td>For the production of Portland cements and other hydraulic binders</td></tr>
<tr><td>Placing on the market/Rules for application on the market/Technical product standards:</td><td>CNP EN 197-1:2012 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 boundaries:	The system evaluated includes the A1-A3 module (product stage). A more detailed description of the system boundary is given in Section 2.1.
Criteria for the exclusion:	The LCA considered the extraction and processing of natural raw materials, the transport of secondary raw materials (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 clinker production (until the end of waste status is reached) for which inventory data is available were considered. Excluded from the system boundary are bag filters, kiln refractory lining, lubricating oils, the production of acetylene used in maintenance operations (welding), sodium hypochlorite, sodium hydroxide, chlorine and biocide used for water treatment, which individually corresponds 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 for each module. 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 2022.
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 4.2), 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 - Outão 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 databasev3.5. 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 on the GCCA, considering the energy matrix of year 2022, based on data from the International Energy Agency (IEA).
Allocation rules:	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 considered, and operations exclusive to other products were excluded. Then, an allocation procedure was applied for the operations included 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. concrete sludge, calcination residues, lime sludge, kiln linings, construction and demolition waste, etc.) and secondary fuels (fuels derived from waste, used tyres, etc.), so the environmental impacts associated with these raw materials and fuels only concern the operations that take place from their transport to the Outão 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 the assessment:	GCCA EPD Tool for Cement and Concrete (V 4.2), 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 EPD construction products':	EPD for construction products and services may not be comparable if they are not produced in accordance with EN 15804 and EN 15942 and in accordance with 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. Diagram of the process input and output flows

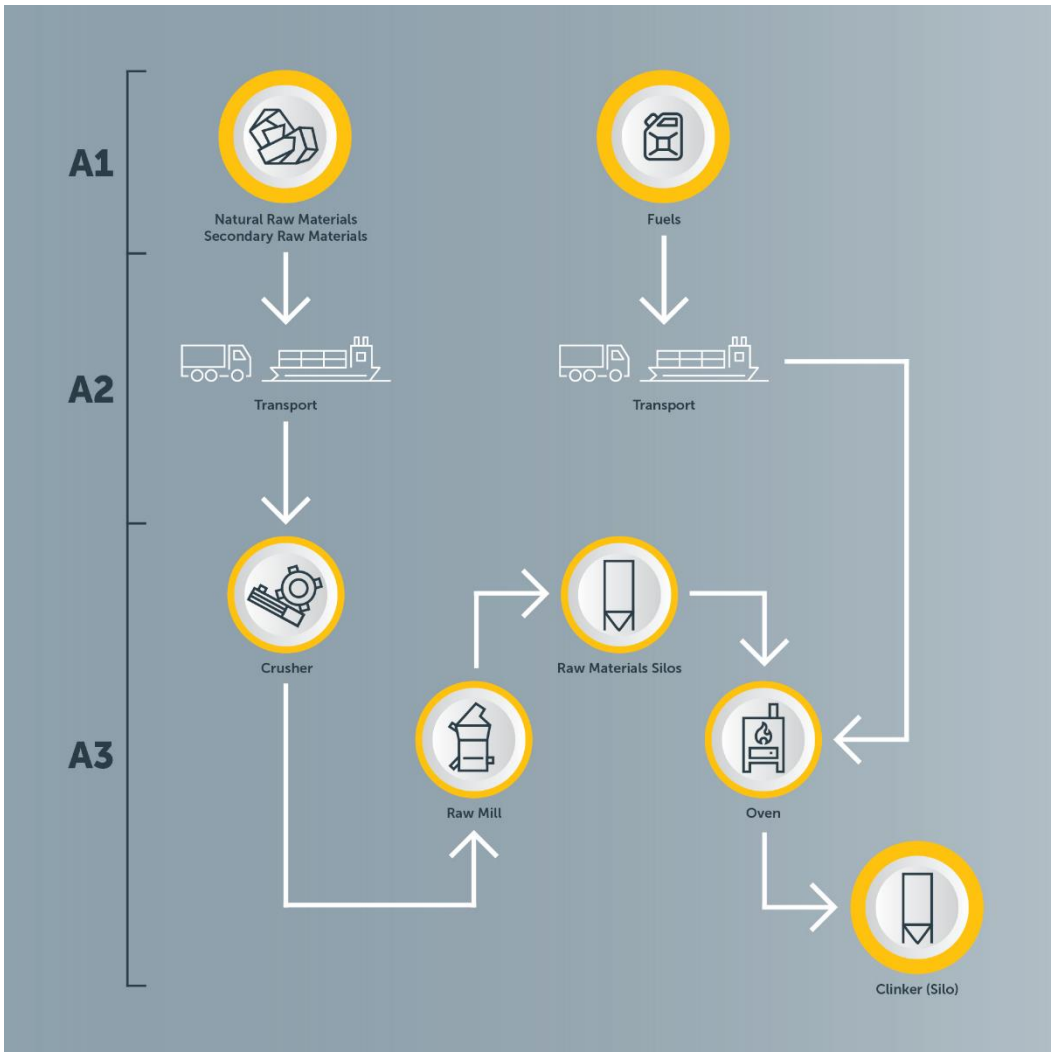

Figure 1: Flowchart of the Portland clinker manufacturing process.

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
Raw materials	Transport	Manufacturing	Transport	Construction and installation process	Use	Maintenance	Repairing	Replacement	Restoration	Operational energy use	Operational water use	Deconstruction and demolition	Transport	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 module A1-A3 (product stage) of Portland clinker considers 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 - the non-recyclable textile component of tyres and refuse-derived fuels).

The main raw materials used to produce Portland clinker are marl 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 (hammer crusher). The extracted material is transported by dump-truck to the crusher. At this stage, secondary raw materials are added to the marl.

This is followed by raw milling, in which the natural and secondary raw materials (materials derived from waste, e.g. concrete sludge, calcination waste, lime sludge, kiln linings, construction and demolition waste) 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. The mill works by injecting water to stabilise the grinding track layer. The water will mix with the raw materials creating a layer height necessary for the grinding process to be efficient. The hot gases coming from the kiln will feed the mill, which will cause some of the water to evaporate, making it necessary to replace it (make-up). This make-up therefore corresponds to actual water consumption. This water comes from the company boreholes and requires treatment with sodium hypochlorite, sodium chloride, bio-dispersant, chlorine and disinfectant to eliminate bacteria and prevent calcification in the equipment, respectively. During milling, the "raw" material is also 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 and tertiary firing air. This air is generated by the cooler's fans

and is therefore divided into secondary air, which goes into the kiln, and tertiary air, which is the air needed for combustion in the calciner. In this way, there is a partial recovery of the clinker's thermal content to reduce energy consumption in the kilns.

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.

Portland clinker is produced 'dry', which means that little water is used throughout the production process, with only water being consumed in the mill, as mentioned above, and irrigation water in the quarry. During the spring/summer months, the quarry paths are watered an average of 2 times a day (100 m^3/day), while during the autumn/winter months they are watered an average of 4 times a day (50 m^3/day). The water used to irrigate the quarry paths and the mill comes from the company boreholes and requires treatment with sodium hypochlorite and sodium chloride to eliminate bacteria and prevent calcification in the equipment, respectively.

The diesel used for internal movements at the Secil plant and quarry comes from diesel refuelling stations at the plant and quarry. Therefore, pollutant emissions to rainwater from hydrocarbon separators associated with the diesel refuelling station and the collection of oily water throughout the plant and in the quarry, associated with the workshop and diesel refuelling station, were considered. The diesel consumption of emergency generators and the pumping unit was also considered 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 the exemption to declare modules C1, C2, C3, C4 and D**

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. Basic environmental impact indicators

	Global warming potential - total; GWP-total	Global warming potential - fossil fuels; 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.
Module A1-A3	8.57E+02	8.57E+02	4.71E-02	5.39E-02	1.39E-05	1.36E+00

LEGEND:

Product Stage

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

	Eutrophication potential of aquatic freshwater; EP-freshwater	Eutrophication potential of aquatic marine; EP-marine	Terrestrial eutrophication potential; EP-terrestrial	Formation potential tropospheric ozone formation; POCP	Abiotic depletion potential for non-fossil resources; ADP-minerals & metals	Abiotic depletion potential for fossil resources; 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 eq. of water globally unavailable
Module A1-A3	6.94E-03	7.24E-04	5.12E+00	1.37E+00	1.19E-04	3.20E+03	2.34E+01

LEGEND:

Product Stage

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

The results obtained for the indicators “Abiotic depletion potential for non-fossil resources (ADP-minerals&metals)”, “Abiotic depletion potential for fossil resources potential (ADP-fossil)” and “Water (user) deprivation potential (WDP)” should be used with caution since 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 emissions of fine particulate matter PM	Potential human exposure efficiency in relation to U235 IRP	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	Potential soil quality index SQP
Unit	Incidence of disease	kBq U 235 eq.	CTUe	CTUh	CTUh	-
Module A1-A3	1.76E-05	4.48E+00	4.93E+01	9.86E-07	1.56E-05	1.28E+03

LEGEND:

Product Stage

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

The impact indicator “potential human exposure efficiency relative to U235” 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 consider effects arising from possible nuclear accidents, occupational exposure or the disposal of radioactive waste in underground facilities. Potential ionising radiation from soil, radon and some building materials is also not measured by this indicator.
The results of the indicators “potential comparative toxic unit for ecosystems (ETP-fw)”, “potential comparative toxic unit for humans, cancer effects”, “potential comparative toxic unit for humans, not cancer effects” and “potential soil quality index” 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
Module A1-A3	8.74E+02	0.00E+00	8.74E+02	3.20E+03	0.00E+00	3.20E+03

LEGEND:

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			
	SM	RSF	NRSF	Net value of fresh water
Unit	kg	MJ, P.C.I	MJ, P.C.I	m^3
Module A1-A3	8.25E+01	3.17E+02	8.50E+02	6.10E-01

LEGEND:

Product Stage

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

SM = use of secondary material; RSF= use of renewable secondary fuels; NRSF = use of non-renewable secondary fuels; Fresh water = use of the net value of fresh water.

2.5. Other environmental information describing different categories of waste

	Hazardous waste disposed	Non-hazardous waste disposed	Radioactive waste disposed
Unit	kg	kg	kg
Module A1-A3	2.10E-01	1.43E-03	0.00+00

LEGEND:

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. Other environmental information describing output flows

	Components for reuse	Materials for recycling	Materials for energy recovery	Exported energy
Unit	kg	kg	kg	MJ
Module A1-A3	0.00E+00	2.06E+00	9.20E+00	0.00E+00

LEGEND:

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 plant gate

Biogenic carbon content*	Units**	Module 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 CO_2

** 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. In accordance with 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.