Low Carbon Cement

ENVIRONMENTAL PRODUCT DECLARATION

CEMENT AUSTRALIA®

Programme: The International EPD® System, www.environdec.com
Programme Operator: EPD International AB
Regional Program: EPD Australasia
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In accordance with ISO 14025 and EN 15804: 2012+A2:2019/AC:2021
For Low Carbon Cement from Cement Australia
"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 [http://www.environdec.com.%20/]www.environdec.com"

MADE Right Here

Program Information and Verification

Programme

The International EPD ® System

Programme Operator

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Regional Programme

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Declaration owner

Cement Australia Pty Ltd

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Web: www.cementaustralia.com.au
Phone: 1300 236 368

The EPD owner has the sole ownership, liability and responsibility for the EPD.

Third Party Verifier accredited or approved by EPD Australasia Ltd

☑ EPD verification by an individual verifier

Jonas Bengtsson

Edge Environment Pty Ltd

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Phone: +61 2 9438 0100

Procedure for follow-up of data during EPD validity involves third-party verifier

☑ Yes ☐ No

In accordance with ISO 14025 and EN 15804:2012+A2:2019/AC:2021 for:

Low Carbon Cement from Cement Australia Pty Ltd will be manufactured from the following locations:

Gladstone: Landing Rd, Fisherman's Landing, Gladstone QLD 4680

Brisbane: 77 Pamela St, Pinkenba QLD 4008

Auburn: Highgate Street, Auburn NSW 2144

West Footscray: 2 Currajong St, West Footscray VIC 3012

Product Category Rules:

CEN standard EN 15804 serves as the Core Product Category Rules (PCR)

Product Category Rules (PCR): 2019:14 Construction Products Version 1.3.4, 2024-04-30

PCR review was conducted by: The Technical Committee of the International EPD System. See www.environdec.com 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

Complementary Product Category Rules (c-PCR): c-PCR-001 Cement and Building Lime (EN 16908:2017+A1:2022), 2024-04-30

EPD Tool: GCCA's Industry EPD Tool for Cement and Concrete (V4.2), International version

Reference Year for Data: 01/01/2023-31/12/2023

General Information

To serve increasing market demand and in particular, to facilitate whole-project, whole-life environmental impact assessment, the cement and concrete industry can provide “cradle to gate” environmental product declarations (EPDs) for their products.

The intention is that EPDs are used by engineers, architects, developers and clients to compare products that have functional equivalence and to pass environmental information down the value chain.

However, EPD’s within the same product category but from different programmes may not be comparable. They also may not be comparable if they do not comply with EN15804+A2. For further information about comparability, see EN15804+A2 and ISO14025.

The Global Cement and Concrete Association (GCCA) makes available to the concrete industry across the world a verified EPD tool (GCCA EPD Tool).

This enables producers to derive EPD data to run comparisons during product development stage and data to input into EPDs.

The GCCA EPD tool is verified against recognised international standards and relevant product category rules.

The EPD tool was originally developed under the Cement Sustainability Initiative, part of the World Business Council for Sustainable Development.

Comparability of EPDs

EPDs within the same product category but registered in different EPD programmes, or not compliant with EN 15804, 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 characterisation factors); have equivalent content declarations; and be valid at the time of comparison. For further information about comparability, see EN 15804 and ISO 14025.

Company information

Owner of the EPD

Cement Australia Pty Ltd

The EPD owner has the sole ownership, liability, and responsibility for the EPD.

Description of the organisation

Cement Australia Holdings Pty Ltd is owned by controlled entities of Holcim Group Ltd (Switzerland) and Heidelberg Cement AG (Germany) in the proportions of 50% and 50% respectively.

Separately, a partnership has been formed between controlled entities of Holcim Group Ltd and Heidelberg Cement AG with interests held in the Cement Australia Partnership in the same proportions of 50% and 50% respectively.

Cement Australia's main business involves the manufacture and sale of cement and cementitious products in Australia. Cement Australia manufactures high performance cement products including customised blends for special applications.

In addition, we supply concrete-grade fly ash and ground granulated blast furnace slag along with high-grade lime products in bulk and packaged forms.

Our products meet required Australian Standards and have been tested to withstand Australian climate conditions.

Cement Australia operates in accordance with its management systems which are certified to the following International Standards:

- **ISO 9001** Quality Management Systems
- **ISO 14001** Environmental Management Systems
- **ISO 45001** Occupational Health and Safety Management Systems.

Name and location of production site(s)

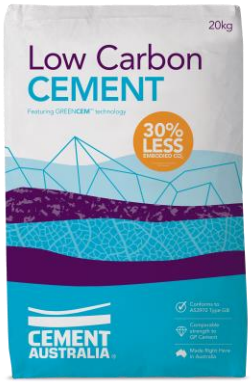
Gladstone: Landing Rd, Fisherman's Landing, Gladstone QLD 4680

Brisbane: 77 Pamela St, Pinkenba QLD 4008

Auburn: Highgate Street, Auburn NSW 2144

West Footscray: 2 Currajong St, West Footscray VIC 3012

Declared Products



Product Name

Low Carbon Cement

Product Identification

Low Carbon Cement (Type GB)

Product Description

Low Carbon Cement is used as a binder in general purpose concrete applications, cement-based products, mortar and grouts where the use of fly ash has been approved. Low Carbon Cement provides a significant reduction in carbon emissions, whilst maintaining compressive strengths in concrete, improved workability and enhanced durability performance of concrete.

Low Carbon Cement is a blend of fly ash and GP Cement that complies with the requirements specified in Australian Standard 3972 for Type GB. It also complies with the AS3972 requirements for Type SL (Shrinkage Limited) and Type SR (Sulphate Resisting) cements.

Fly ash is a by-product of coal combustion in power stations. Aside from offering environmental advantages by re-using industry waste, blending fly ash with General Purpose Cement also improves the overall performance and quality of concrete.

Low Carbon Cement, when incorporated into a concrete mix, can be expected to provide the following benefits:

- Lower embodied carbon content
- Comparable compressive strengths to GP Cement
- Improved workability and pumpability
- Reduced water demand
- Lower drying shrinkage and creep
- Improved resistance to sulphate attack and chloride penetration
- Reduced potential for Alkali Aggregate Reaction

Manufacturing Process

Low Carbon Cement is a blend of GP Cement, Fly Ash and proprietary additives. These are supplied in bulk and do not have any packaging associated with them. Our bulk terminals blend the raw materials together using either pneumatic or mechanical equipment which is then transferred to our regional rotating packaging system for packaging into 20kg paper sacks ready for sale. Low Carbon Cement is manufactured at multiple Cement Australia facilities. Of these the facility with the highest associated environmental values (Auburn) was used to represent all sites.

UN CPC Code

3744

Declared Products

Product Composition

The nominal product composition of Low Carbon Cement is presented in the following table.

Material Description	Weight, kg	Post-consumer material weight, kg	Biogenic material weight, kg	Biogenic material, kg C/ declared unit
Clinker	606	0.0	0.0	0.0
Fly Ash	297	0.0	0.0	0.0
High Grade Limestone	52	0.0	0.0	0.0
Gypsum	35	0.0	0.0	0.0
GreenCem	10	0.0	0.0	0.0

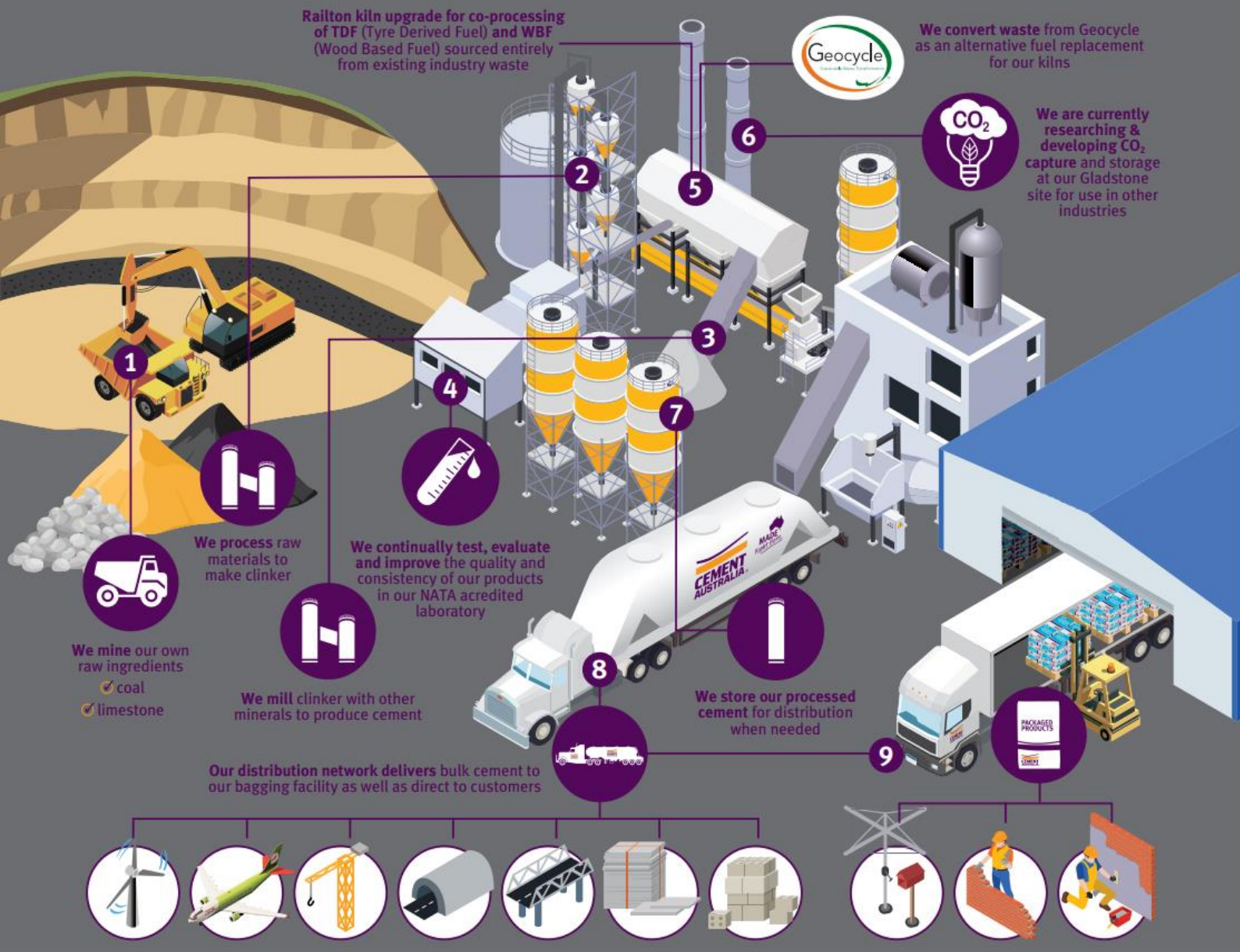
Packaging materials	Weight, kg	Weight-% (versus the product)	Biogenic material, kg C/ declared unit
Paper	3.67	0.367	0.184
Plastic Film	0.16	0.016	0.0
Sum	3.83	0.383	0.184

- This product is classified as Hazardous according to the Safe Work Australia guidelines for Globally Harmonised System of Classification and Labelling of Chemicals (GHS)
- No materials contained in the product or packaging are listed on the REACH Candidate list for Substances of Very High Concern.

Cement Australia Process Overview

Mined. Milled. Manufactured.

Our cement has been proudly Made Right Here in Australia since 1890



Life Cycle Assessment (LCA) Information

Description of System Boundaries

This EPD covers the cradle to gate life cycle stages (A1–A3) of cement production.

This system includes the extraction and production of raw materials, transportation of raw materials to the cement plant, cement manufacturing process (including onsite transportation) and treatment of waste produced within the processes throughout the cement plant.

According to EN 15804:2012+A2:2019/AC:2021 Section 5.2, EPDs of this type shall only be used where the following three conditions are valid:

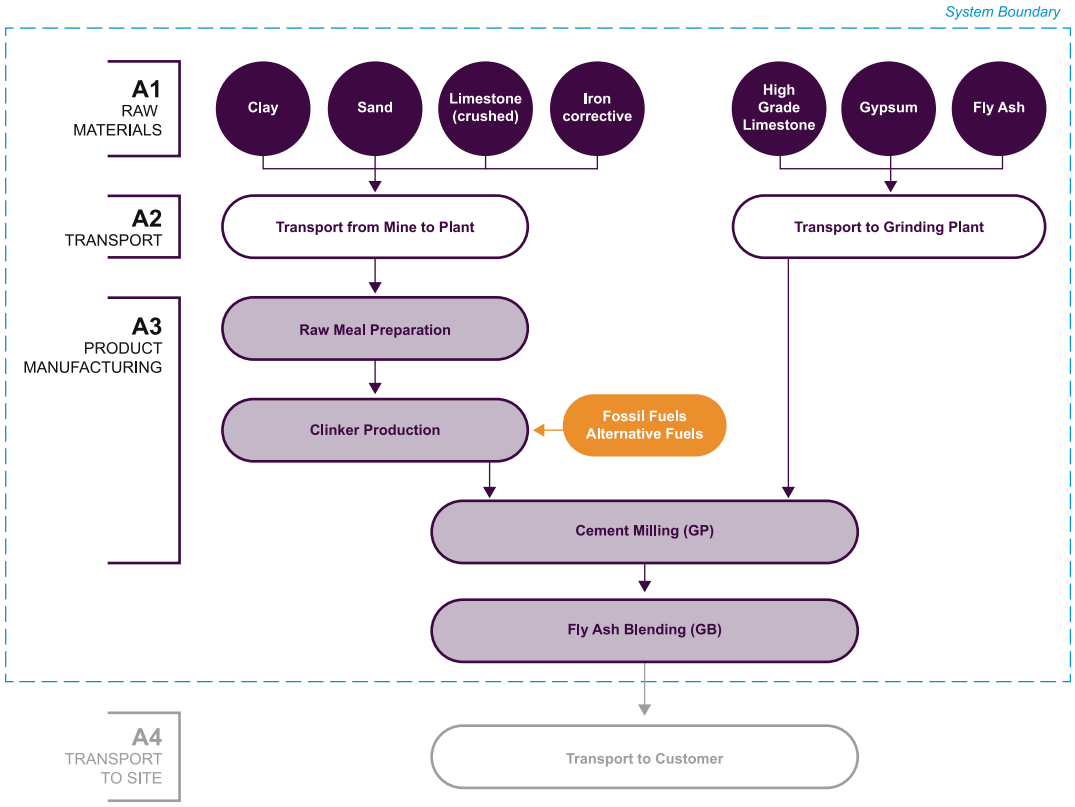
- the product or material is physically integrated with other products during installation so they cannot be physically separated from them at end of life, and
- the product or material is no longer identifiable at end of life as a result of a physical or chemical transformation process, and
- the product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

All processes related to the use stage, and end of life of cement and module D are outside the scope of this EPD as cement will be used as a mix component in manufacturing for other products (i.e., concrete and masonry) and cement cannot be physically separated from other products at end of life.

The EPD covers the product stage (“cradle to gate”, A1-A3).

The selected system boundaries comprise the production of cement including raw material extraction up to the finished product at the factory gate. They are in accordance with the system boundaries given in EN 16908:2017.

System Diagram



Life Cycle Assessment (LCA) Information

Scope of EPD

	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	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction 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
Modules Declared	X	X	X	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Specific data used	>90%																
Geography	AU	AU	AU	-	-	-	-	-	-	-	-	-	-	-	-	-	-

X - Module is included in this study, ND - Module is not declared

Declared Unit

1 tonne

Reference Service Life

Not applicable

Time Representativeness

All material and energy flows within the scope of the study are based on plant specific data collected between 01/01/2023 – 31/12/2023.

Database(s) and LCA Software Used

GCCA EPD tool EN59 A2 software. Industry EPD Tool for Cement and Concrete (V4.2), International version.

The life cycle inventory database used in the tool is the ecoinvent database (v3.5), cut-off system model. The ecoinvent LCI database is the most widely used LCI database worldwide and the reference database for a large number of EPDs and sector-specific LCI datasets.

Manufacturing Site Variation

The GWP-GHG results from Modules A1-A3 varied by less than 10% between manufacturing sites.

Life Cycle Assessment (LCA) Information

Background Data

The data provided for use in this EPD has been taken directly from the Gladstone Technical Information System (TIS) network and reflects real time data measured and collated by our process systems. All applicable data is derived by devices and instrumentation that are calibrated against the relevant Australian and International standards.

The source of Electricity supply data is the Department of Climate Change, Energy, and Environment and Water, Energy Statistics, Table O, 2024 and considers green electricity. The CO_{2e}/kWh factor used is 0.8.

Australian electricity generation, by fuel type, physical units, financial year 2022-2023 QLD

Non Renewable Fuels	GWh	Renewable Fuels	GWh
Black Coal	4.32E4	Biomass	9.14E2
Brown Coal	0.0E0	Wind	2.13E3
Natural Gas	9.13E3	Hydro	1.2E3
Oil Products	1.2E3	Large-scale solar PV	5.41E3
		Small-scale solar PV	7.21E3
		Geothermal	0.0
Total	**5.39E4**	**Total**	**1.72E4**
Percentage supply	**76%**	**Percentage supply**	**24%**

Transport distances were calculated based on the distance between the material source and its destination.

Life Cycle Assessment (LCA) Information

Data Quality

Information and data utilised in this document is correct and factual at time of development.

High data quality is achieved through the use of real time, independently calibrated monitoring systems which capture resource use. Overall, the data quality for this LCA was considered High.

The EPD will be updated if changes in its life cycle inventory led to a variation of 10% or more in any of the included environmental indicators during its validity period.

Module	Input/Output	Data Source	Temporal Scope	Quality
A1	Clinker (CA produced at plant)	Gladstone Technical Information System	2023	High
	Gypsum			
	Limestone			
A2	Transport	Actual Transport distances per trip	2023	High
A3	Electricity and natural gas used for manufacturing of cement	Site Electricity and gas meters & billing information	2023	High

Packaging

The raw materials of clinker, gypsum and limestone are either produced from Cement Australia mining activities or sourced in bulk quantities with no associated packaging.

Life Cycle Assessment (LCA) Information

Cut Off Rules

According to EN15804:2012+A2:2019/AC:2021, Section 6.3.6, LCA data shall include a minimum of 95% of total inflows (mass and energy) per module. In addition, if less than 100% of the inflows are accounted for, proxy data or extrapolation should be used to achieve 100% completeness.

For this LCA, it has been assumed that infrastructure/capital equipment and personnel have an impact that is not material and thus have not been included in the system boundary.

In addition, personnel travel to and from work has also not been included as it is assumed if they were not employed by Cement Australia for the production of cement, they would be employed by another business.

Based on this guidance, all inflows and outflows have been accounted for.

Allocation Rules

For Secondary Materials (Co-Products), EN15804:2012+A2:2019/AC:2021 allocation rules require allocation to be based on physical properties (e.g., mass or volume) when the difference in value from the co-products is low (difference in revenue of the main and co-product is less than 25%).

For co-products where the difference in revenue from the main and co-product is greater than 25% (e.g co-product revenue is 10% of main product revenue), an economic allocation factor shall be determined and reported in the data survey.

Regarding inputs into Cement, ground granulated blast furnace slag (GGBFS) has been allocated economically in accordance with the rules of EN 15804 using EF reference package 3.0 using the 2023 average price for copper and GGBFS in Australia. Other secondary material inputs are defined as waste and have a zero allocation as they have no end use.

Assumptions

The key choices and assumptions in this LCA are:

- The environmental profiles are largely influenced by the primary data, which are considered high quality.
- Fly Ash is considered a waste product in this EPD and has a zero allocation factor.
- Transport distances have been calculated as a direct route from material source to plant.

Environmental Indicators

Impact categories included in this assessment

Core environmental impact indicators	Acronym	Unit
Global warming potential, excluding biogenic uptake, emissions and storage	GWP-GHG	kg CO_2 equivalent
Global warming potential (total)	GWP (total)	kg CO_2 equivalent
Global warming potential (fossil)	GWP (fossil)	kg CO_2 equivalent
Global warming potential (biogenic)	GWP (biogenic)	kg CO_2 equivalent
Global warming potential (land use / land transformation)	GWP (luluc)	kg CO_2 equivalent
Ozone depletion potential	ODP	kg CFC-11 equivalent
Acidification Potential	AP	mol H^+ eq.
Eutrophication – aquatic freshwater	EP - freshwater	kg P equivalent
Eutrophication – aquatic marine	EP - marine	kg N equivalent
Eutrophication – terrestrial	EP - terrestrial	mol N equivalent
Photochemical ozone creation potential	POCP	Kg NMVOC equivalent
Abiotic depletion potential for mineral elements	ADPE	kg Sb equivalent
Abiotic depletion potential for fossil fuels	ADPF	MJ
Water Depletion Potential	WDP	m^3 equivalent

Environmental Indicators

Parameters describing resource use

Resource Use indicators	Acronym	Unit
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	PERE	MJ_{NCV}
Use of renewable primary energy resources used as raw materials	PERM	MJ_{NCV}
Total use of renewable primary energy resources	PERT	MJ_{NCV}
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	PENRE	MJ_{NCV}
Use of non-renewable primary energy resources used as raw materials	PENRM	MJ_{NCV}
Total use of non-renewable primary energy resources used as raw materials	PENRT	MJ_{NCV}
Use of secondary material	SM	kg
Use of renewable secondary fuels	RSF	MJ_{NCV}
Use of non-renewable secondary fuels	NRSF	MJ_{NCV}
Use of net fresh water	FW	m^3

Parameters describing waste

Waste Category	Acronym	Unit
Hazardous waste disposed	HWP	kg
Non-hazardous waste disposed	NHWD	kg
Radioactive waste disposed	RWD	kg

Environmental Indicators

Parameters Describing Output Flows

Output flows	Acronym	Unit
Components for re-use	CRU	kg
Materials for recycling	MFR	kg
Materials for energy recovery	MER	kg
Exported Energy	EE	MJ

Additional Environmental Impacts

Disease potential	Acronym	Unit
Potential incidence of disease due to PM emissions	PM	Disease incidence
Potential Human exposure efficiency relative to U235	IRP	kBq U-235 eq
Potential Comparative Toxic Unit for ecosystems	ETP-fw	CTUe
Potential Comparative Toxic Unit for humans - cancer	HTP-c	CTUh
Potential Comparative Toxic Unit for humans - non-cancer	HTP-nc	CTUh
Potential soil quality index	SQP	dimensionless

Extra Indicators

Disease potential	Acronym	Unit
Emissions from calcination and removals from carbonation	CC	kg CO_2 equivalent
Emissions from combustion of secondary fuels from renewable sources used in production processes	CWRS	kg CO_2 equivalent
Emissions from combustion of secondary fuels from non-renewable sources used in production processes	CWNRS	kg CO_2 equivalent
Removals and emissions associated with biogenic carbon content of the bio-based product	GWP-Prod	kg CO_2
Removals and emissions associated with biogenic carbon content of the bio-based packaging	GWP-Pack	kg CO_2

Environmental Performance Results

Potential Environmental Impact – Mandatory Indicators according to EN 15804+A2

The estimate impact results are only relative statements, which do not indicate the endpoints of the impact categories, exceeding threshold values, safety margins and/or risks.

Core Environmental Indicators

Indicator	Unit	Tot.A1-A3
GWP-GHG	kg CO_2 equivalents	5.44E2
GWP-total	kg CO_2 eq.	5.44E2
GWP-fossil	kg CO_2 eq.	5.44E2
GWP-biogenic	kg CO_2 eq.	5.2E-2
GWP-luluc	kg CO_2 eq.	8.03E-2
ODP	kg CFC 11 eq.	6.05E-6
AP	mol H^+ eq.	7.78E0
EP-freshwater	kg P eq.	9.05E-2
EP-marine	kg N eq.	6.04E-3
EP-terrestrial	mol N eq.	4E0
POCP	kg NMVOC eq.	9.7E-1
ADPE	kg Sb eq.	1.32E-4
ADPF	MJ	2.44E3
WDP	m^3	2.69E1

Per tonne cement produced

** Disclaimer: The results of this environmental impact indicator shall be used with care as the uncertainties of these results are high or as there is limited experience with the indicator.*

Environmental Performance Results

Parameters describing resource use

Indicator	Unit	Tot.A1-A3
PERE	MJ	1.55E1
PERM	MJ	6.24E0
PERT	MJ	2.17E1
PENRE	MJ	2.44E3
PENRM	MJ.	7.65E0
PENRT	MJ	2.44E3
SM	kg	3.3E2
RSF	MJ	0E0
NRSF	MJ	2.24E2
FW	m^3	7.28E-1

Per tonne cement produced

Environmental Performance Results

Parameters describing waste

Indicator	Unit	Tot.A1-A3
HWD	kg	0E0
NHWD	kg	4.12E-1
RWD	kg	0E0

Per tonne cement produced

Parameters describing output flows

Indicator	Unit	Tot.A1-A3
CRU	kg	0E0
MFR	kg	0E0
MFRE	kg	0E0
EE	MJ per energy carrier	0E0

Per tonne cement produced

Extra Indicators

Indicator	Unit	Tot.A1-A3
CC	kg CO_2 eq.	3.01E2
CWRS	kg CO_2 eq.	0.0E0
GWP-Prod	Kg CO_2	0.0E0
GWP-Pack	Kg CO_2	-6.73E0

Per tonne cement produced

Environmental Performance Results

Potential Environmental Impact – Additional Mandatory and Voluntary Indicators

Indicator	Unit	Tot.A1-A3
PM	Disease incidence	1.33E-5
IRP	kBq U235 eq	3.36E3
ETP	CTUe	7.88E1
HTPC	CTUh	9.82E-7
HTPNC	CTUh	3.35E-5
SQP	dimensionless	3.08E2

Per tonne cement produced

References

Australasian EPD Programme (2018), Guidance on the use of background LCI data.

Australasian EPD Programme (2023), Instructions of the Australasian EPD Programme V4.2.

AS/NZS 3972:2010, General purpose and blended cements.

AS 3582.1:2016, Supplementary cementitious materials Part1: Fly Ash.

AusLCI 2023, Australian Life Cycle inventory database v1.42, published by the Australian Life Cycle Assessment Society, 2023.

GCCA2022, EPD Tool: GCCA's Industry EPD Tool for Cement and Concrete (V4.2), International version.

The International EPD System, General Program Instruction for The International EPD System version 4.0 (2021). *Retrieved from www.envirodec.com*

ISO14040:2006 Environment Management – Life cycle assessment – Principles and framework. International Organisation for Standardisation, Geneva Switzerland, 2006.

ISO14044:2006, Environmental Management, Life cycle assessment – Requirements and guidelines, International Organisation for Standardisation, Geneva, Switzerland, 2006.

ISO14025:2006, Environmental labels and declarations – Type III environmental declarations – Principles and procedures. International Organisation for Standardisation, Geneva, Switzerland, 2006.

The International EPD System, Product Category Rules (PCR) for Construction Products, PCR 2019:14 v1.3.4 (2024). *Retrieved from www.envirodec.com*

The International EPD System, Complementary Product Category Rules (C-PCR) to PCR 2019:14 Cement and Building Lime. (2024). *Retrieved from www.envirodec.com*

EPD-IES-0012808:001 (S-P-12808) Concrete Roof Tiles Northstone Materials Ltd. *Retrieved from www.envirodec.com*