ENVIRONMENTAL PRODUCT DECLARATION

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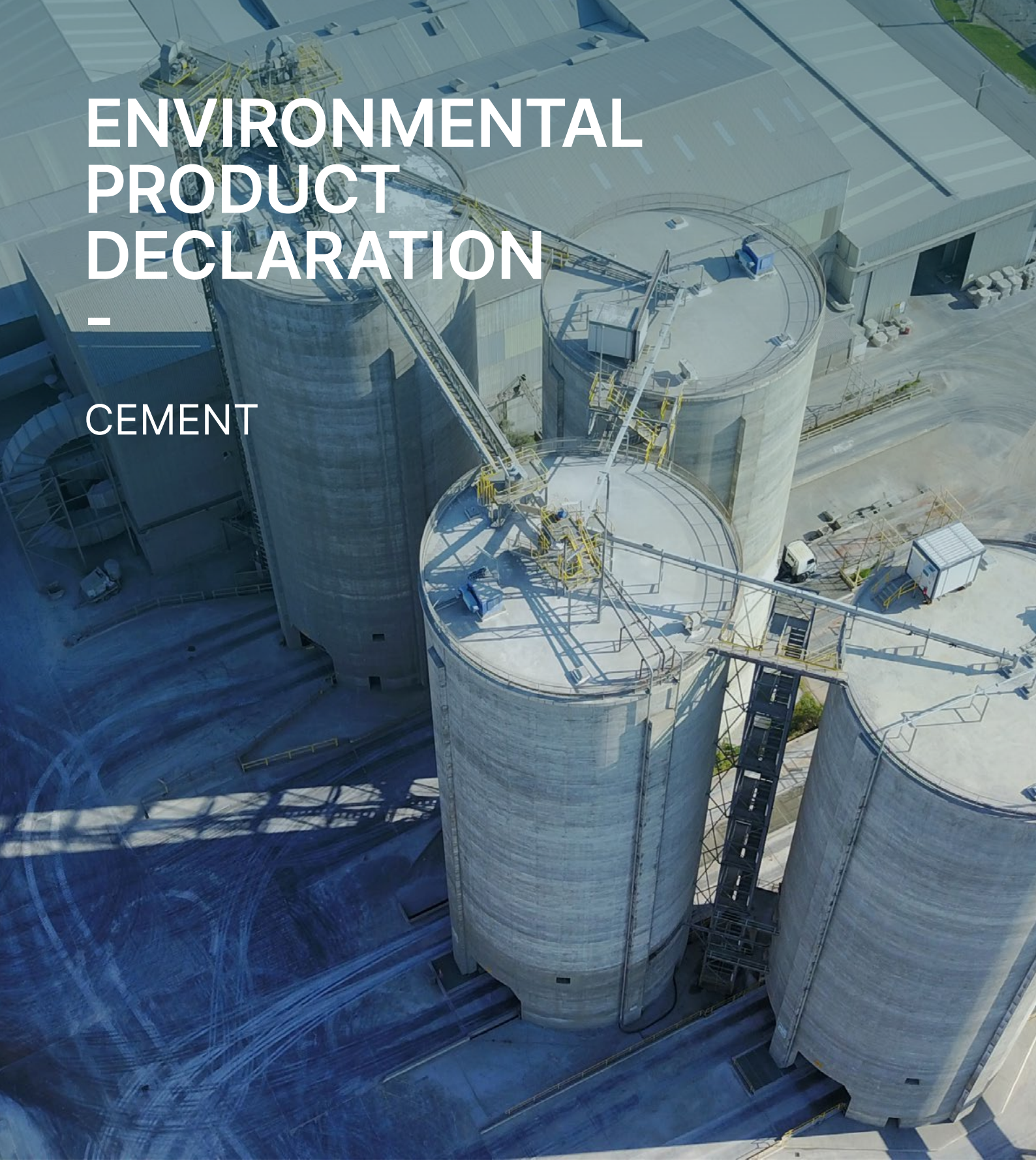
CEMENT



In accordance with ISO 14025 and EN 15804:2012+A2:2019

EPD Registration no. S-P-07439 | Version 1.0
15 March 2023 | Valid to 15 March 2028
Geographical Scope: Western 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 www.epd-australasia.com

BGC Cement

AUSTRALASIA EPD
ENVIRONMENTAL PRODUCT DECLARATION

ECO PLATFORM EPD VERIFIED

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Contents

BGC Cement

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Building on 60 years of industry experience, BGC Cement, a Western Australian owned company, provides the foundation upon which many residential, commercial, mining and engineering projects are built.

We provide a wide range of cement types, with an annual production capacity of nearly 1.2 million tonnes. Our cement range is suitable for general premixed concrete applications, concrete precast, concrete products manufacture, cemented aggregate fill, cemented paste fill, controlled low strength material, shotcrete, road stabilisation and culvert backfill purposes.

BGC Cement has a commitment to our community and a passion for excellence in everything we do. We operate to the highest industry standards and maintain ISO 9001:2015 Quality Management, ISO 14001:2015 Environmental Management and ISO 45001:2018 Occupational Health and Safety Management Systems certifications.

Today, BGC Cement employs more than 100 people and delivers cement throughout Western Australia from its two sites in Naval Base (Perth Metropolitan Region) and Kalgoorlie.

Cementitious Products

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Our Locations

BGC Cement Naval Base
BGC Cement's manufacturing facility is located at Naval Base, within the Perth Metropolitan Region. Naval Base has a storage capacity of more than 400,000 tonnes of raw material and over 42,000 tonnes of finished product.

BGC Cement Kalgoorlie
BGC Cement's Kalgoorlie depot was established in 2020 to expand our mining-related capability, providing distribution of cement and lime to the Goldfields region.

The 20,000sqm depot has a 5000-tonne combined storage capacity for our cement and lime products.

Figure 1: Locations of BGC Cement facilities

This EPD only covers products exiting our Naval Base site.

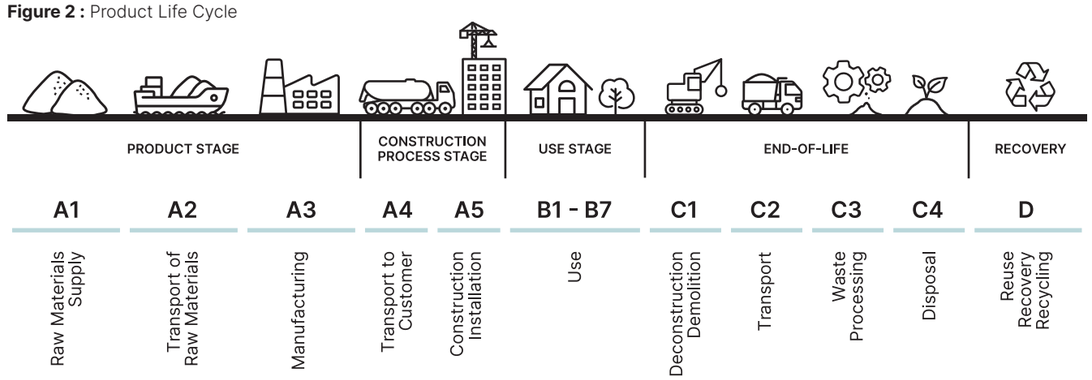
Product Life Cycle

Creating an EPD is an extensive process based on a set of Product Category Rules (PCR) and a Life Cycle Assessment (LCA). Environmental data, such as fuels and explosives (raw material) usage through to production of cement is evaluated, modelled, and then reported through an independently verified EPD.

This EPD is a "cradle-to-gate" declaration covering production of cementitious materials and their supply chain.

The construction process (modules A4-A5), use stages (B1-B7) and end-of-life modules (C1-C4 and D) have not been modelled as these are best modelled at the building or infrastructure project level given the vast and varied applications of cement. See S-P-05491 Ready-Mix Concrete and S-P-05492 Hollowcore Planks EPD's for specific applications to C1-C4 & D.

Figure 2 : Product Life Cycle



Cement Production

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Cement Production Process

BGC Cement procures high-grade raw materials from both local and overseas sources, which are stored at our Naval Base facility.

Utilising heavy-duty ball mills, we convert the raw materials into various Bulk Milled Cement and Slag products which can also be blended into special purpose cements.

Finished goods are stored in large purpose built silos or as packaged product inventory, ready for distribution to the market.

Cement products can be provided in bulk pneumatic tankers, bulker bags (FIBCs) or conventional paper sacks.

Bulk cements are also transferred to our Kalgoorlie distribution depot via rail, to support our mining clients.

Our Products (Covered in this EPD)

Bulk Milled Products

- Bulk General Purpose (BGP)
- Ground Granulated Blast Furnace Slag (GGBFS) / Bulk Milled Slag (BMS)

Bulk Blended Products

- Bulk Low Heat Cement (BLH)

Our Products (Not Covered in this EPD)

Bulk Milled Products

- Bulk Ultra-Creme Cement (BUCHE)
- Bulk High Early Cement (BHE)

Other Product Lines

- Paper Sack Products
- Bulker Bag Products
- Drymix Products

Product Applications

Product	Application
Bulk General Purpose (BGP)	Mostly used for production of concrete and concrete related products such as house slabs, driveways, and footpaths. It is also used in other popular products like mortars, grouts, and renders.
Bulk Ultra-Creme Cement (BUCHE)	Often used in the manufacture of retaining walls, panels, pre-cast, tilt up, blocks, bricks, pavers, and ornaments. The high early strength, or fast strength, gives excellent turnaround on moulded products and formwork.
Bulk High Early Cement (BHE)	High Early (HE) strength cement can replace (General Purpose) GP Cement in all applications but is typically used where higher than normal early strengths are required. This is usually in concrete product applications like roof tiles, soak wells, lids, pipes, precast and tilt-up concrete, ready-mix, and where early stripping of formwork is desired.
Ground Granulated Blast Furnace Slag (GGBFS) / Bulk Milled Slag (BMS)	GGBFS is typically blended with General Purpose Cement and used in ready-mix concrete and mining backfill applications.
Bulk Low Heat (BLH)	Ideal for use in mass concrete structures to reduce the risk of thermal cracking. Early age strength development is slower than GP cement concrete. However, strength development from 28 days onwards is equivalent or better.

Content Declaration

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Table 1: Product composition, per declared unit

Product Components	Mass, kg	Post-cosumer material, mass %	Renewable material, mass %	CAS No.	EC No.
Bulk GP cement	**1,000**	**0%**	**0%**		
Portland cement clinker	<95%	0%	0%	65997-15-1	266-043-4
Limestone	<8%	0%	0%	471-34-1	207-439-9
Gypsum	2-8%	0%	0%	13397-24-5	603-783-2
Quartz (crystalline silica)	<2%	0%	0%	14808-60-7	238-878-4
Hexavalent chromium	<0.002%	0%	0%	18540-29-9	-
Bulk milled slag (GGBFS)	**1,000**	**0%**	**0%**		
Slag	>99%	0%	0%	65996-69-2	266-002-0
Quartz (crystalline silica)	<1%	0%	0%	14808-60-7	238-878-4
Bulk Low Heat cement	**1,000**	**0%**	**0%**		
Bulk GP cement	35%	0%	0%	65997-15-1	266-043-4
Bulk milled slag	65%	0%	0%	65996-69-2	266-002-0

The products included in this EPD do not contain any substances of very high concern as defined by European REACH regulation in concentrations >0.1% (m/m).

Industry Classification

The UN CPC and ANZSIC codes applicable to cementitious products are listed below:

- UN CPC 374 (Plaster, lime, and cement)
- ANZSIC 20310 (Cement manufacturing)

Declared Unit

- 1 tonne of cementitious product (in bulk), as ordered by our clients.

The information contained in this EPD applies to all bulk products listed in Table 1 (i.e. no packaging is used).

The EPD is product-specific; i.e. no averaging across products or sites was necessary.

Technical Information

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Technical Compliance

BGC Cement does not simply manufacture cement but develops innovative solutions based on local knowledge and experience. Our Cement team consists of highly committed customer and quality focused members with extensive experience in all aspects of the construction industry.

Climate change has motivated BGC Cement and its customers to work towards a carbon neutral future, the publication of this EPD is an important step in this process.

BGC Cement maintains an ISO 9001 certified Quality System to ensure we meet Australian Standards in the construction industry. Cement and GGBFS Bulk Milled Slag is sampled and tested by a NATA certified laboratory to ensure compliance with AS3972-2010 and AS3582.2-2016 respectively.

BGC Cement products are ATIC SP43 registered products under the Cementitious Material Registration Scheme (CMRS).

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System Boundary

This EPD covers the cradle-to-gate life cycle stages (modules A1-A3)*. Downstream stages have not been included in this EPD as there are many applications for our cement products. Please refer to BGC's Ready-Mix Concrete EPD for the specific application to downstream stages of cement in concrete (modules A1-A3, C1-C4 and D) and BGC's Hollowcore Planks EPD for the specific application to downstream stages of cement in precast hollowcore planks (A1-A3, C1-C4 and D).

The modules declared, geographical scope, share of specific data (in GWP-GHG indicator) and data variation are shown in Table 2.

Table 2: 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	Deconstruction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
Module	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Modules declared	✓	✓	✓	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Geography	AU, ID, JP, TH, MY	AU	AU	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Specific data used	Cement: 88%, GGBFS: 86%			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation - products	not relevant			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation - sites	not relevant			-	-	-	-	-	-	-	-	-	-	-	-	-	-

✓: Module is declared
ND: Module is not declared

*The conditions for the exclusion of other life cycle modules have been met as the cementitious products are physically integrated with other products (e.g. aggregates and water to form concrete) during the downstream manufacturing / installation stage so they cannot be physically separated from them at end of life, the products are no longer identifiable at end of life as a result of a physical or chemical transformation process, and the products do not contain biogenic carbon.

Product Stage

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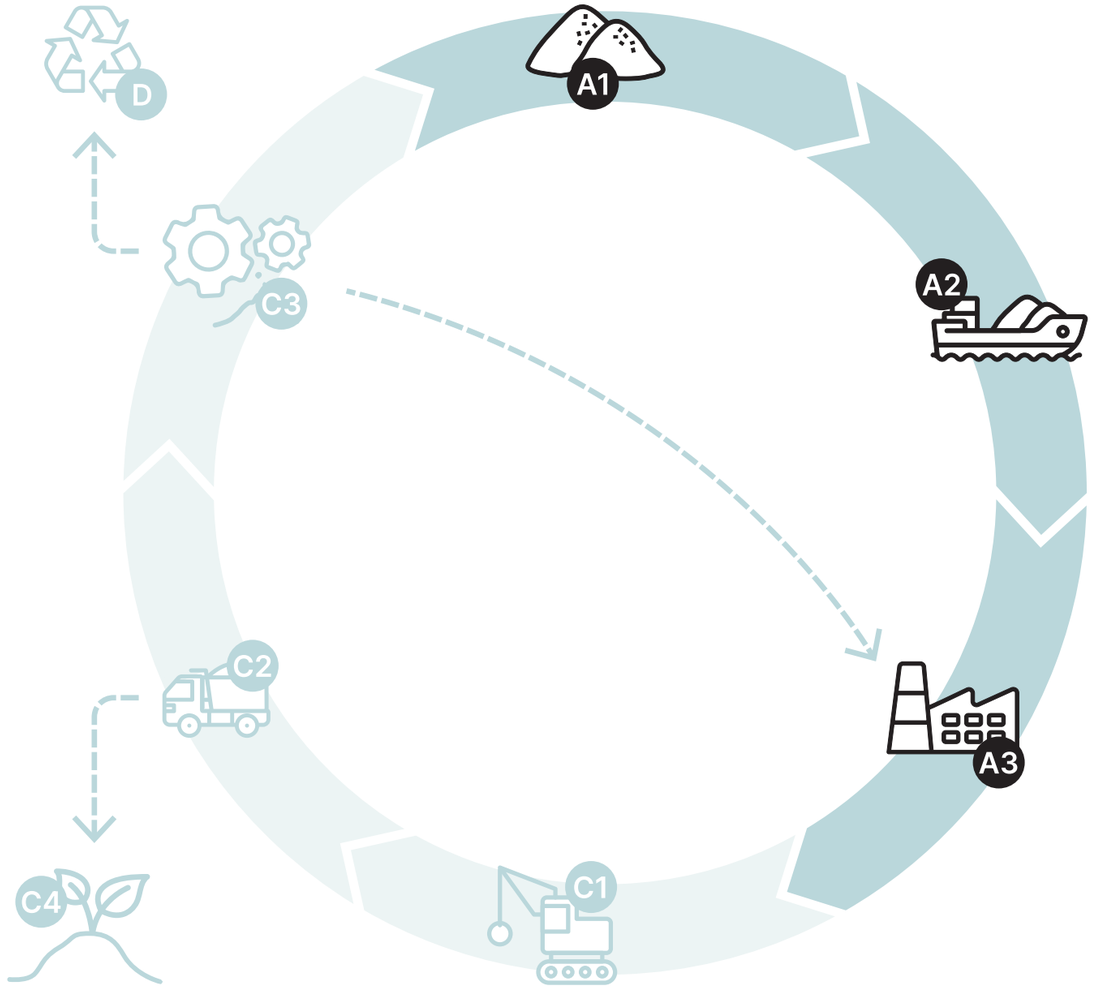
Figure 4: Product Stage and End-of-Life



A4-A5 and B1-B7, C1-C4 and D are excluded from this EPD as there are many applications of cementitious products.
Information about end-of-life scenarios for cementitious products can be found in EPDs that use our materials, for example in BGC Concrete's EPD.

Product Stage (A1-A3)

Investigates the environmental impacts related to the manufacturing of cement before it leaves the manufacturing plant.

A1 Raw Material Supply
Procurement of high-grade raw materials from both local and overseas sources.

A2 Transportation
Transport of Raw Materials to BGC Cement Site via Bulk Shipping Vessel and/or Tipper Trucks.

A3 Manufacturing
Manufacturing of cement through drying, milling, (optional) blending, and storage.

End-of-Life (C1-C4 & D)

Investigates the environmental impacts related to the cement after it has reached the end of its useful life. While not part of the scope of this EPD, the circularity of cementitious products is important. Refer to BGC's Ready-Mix Concrete EPD (S-P-05491) and Hollowcore Planks EPD (S-P-05492) for specific applications to C1-C4 and D.

C1 Demolition
Demolition of product containing cementitious products.

C2 Transport
Transport of demolished product for processing or to landfill.

C3 Waste Processing
Processing of product containing cementitious products.

C4 Disposal
Landfill of product containing cementitious products.

D Resource Recovery Stage
Reuse, recovery, and recycling potential of the product after its end-of-life.

Life Cycle Assessment (LCA) Methodology

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Background Data

BGC Cement has collected and supplied the primary data for the cementitious products LCA based on the FY21 reporting period (1 July 2020 – 30 June 2021). BGC Cement's clinker supplier has provided key information regarding clinker production and composition for the FY21 period. Background data (e.g. for other raw materials, energy and transport processes) have predominantly been sourced from AusLCI and the AusLCI shadow database (v1.36) (AusLCI 2021), as well as ecoinvent v3. Background data used are either less than 10 years old or have been reviewed within this period.

Methodological choices have been applied in line with EN 15804; deviations have been recorded.

Allocation

The key process that requires allocation is the shared milling of cement and Bulk Milled Slag (GGBFS):

- GP cement and Bulk Milled Slag are both milled in the same facility. A breakdown per product of electricity consumption is not available. The energy (electricity and diesel) required for the grinding process is allocated to both products based on their share in the total mass of product.
- Blast furnace slag receives some environmental impacts from pig iron production. This allocation decision has a significant effect on the environmental profile of Bulk Milled Slag and Low Heat Cement.

Cut-off Criteria

The cut-off criteria applied are 1% of renewable and non-renewable primary energy usage and 1% of the total mass input of a process, while considering environmental impacts of small flows:

- Although grinding media and grinding aids make up less than 1% of material flows, they have been included as data is available. The packaging used for grinding media and grinding aids is well below the materiality cut-off and these materials have been excluded.
- Greases, lubricants and welding gases used for maintenance of equipment have not been included. The impact on the environmental footprint of the cementitious products is negligible.
- The contribution of capital goods (production equipment and infrastructure) and personnel is excluded, as these processes are non-attributable and they contribute less than 10% to GWP-GHG.

Key Assumptions

The key choices and assumptions in the LCA are:

- Clinker is sourced from a third party. Clinker data are based on adapted ecoinvent v3 data for clinker production. The composition of the clinker has been adjusted, as well as the type and quantity of fuels used in the clinker kiln, the source of the electricity used, and the amount of carbon dioxide emissions (fossil and biogenic) associated with fuel combustion and the calcination process.
- Blast furnace slag receives some environmental impacts from pig iron production. This allocation decision has a significant effect on the environmental profile of Bulk Milled Slag and Low Heat Cement.
- Electricity used in production has been modelled using the electricity consumption mix on the WA market. The GWP-GHG intensity of the electricity used in the model is 0.69 kg CO_2e/kWh.

Environmental Impact Indicators

An introduction to each environmental impact indicator is provided below, along with the best known cause and effect.

Global Warming Potential (GWP)
Is due to the heat absorbed by greenhouse gases, causing the rise of the global temperature.

Photochemical Smog (POCP)
Is due to a mixture of pollutants which includes volatile organic compounds, particulates, nitrogen oxides and ozone. It's harmful to human health (causing lung irritation problems, coughing and wheezing) and the environment (damage to plants and crops).

Acidification Potential (AP)
Is due to emissions of acids, causing the degradation of materials such as metals, limestone and concrete, and damage to trees and life in lakes and rivers.

Abiotic Resource Depletion (ADP)
Is due to extraction and consumption of non-renewable resources such as oil, coal and metals, causing a decrease in future availability of functions supplied by these resources.

Eutrophication Potential (EP)
Is due to emissions of nutrients, causing blooms of algae. The degradation of dead algae consumes oxygen leading to the loss of plants and animals.

Ozone Depletion Potential (ODP)
Is due to emissions which destroy the ozone layer causing higher levels of UV light to reach earth which damages DNA in humans, animals and plants.

Water Deprivation Potential (WDP)
Is due to water availability versus demand. The less water remaining per area, the more likely another user will be deprived.

Life Cycle Assessment (LCA) Results

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Environmental Profiles for Cementitious Products

The background LCA serves as the foundation for this EPD. A LCA analyses the environmental processes in the value chain of a product. It provides a comprehensive evaluation of all upstream (and sometimes downstream) material and energy inputs and outputs. The results are provided for a range of environmental impact categories, in line with EN 15804:2012+A2:2019.

The cradle-to-gate (module A1-A3) environmental profiles are expressed per tonne (1,000 kg) of bulk cementitious product.

Table 3: Potential environmental impacts – mandatory indicators according to EN 15804:2012+A2:2019

Indicator	Abbreviation	Units	Bulk GP cement ex Naval Base	Bulk milled slag ex Naval Base	Bulk low heat ex Naval Base
Global Warming Potential - total	GWP-total	kg CO_2-eq.	1040	146	466
Global Warming Potential - fossil fuels	GWP-fossil	kg CO_2-eq.	1030	146	460
Global Warming Potential - biogenic	GWP-biogenic	kg CO_2-eq.	1.42E+01	3.67E-01	5.24E+00
Global Warming Potential - land use and land use change	GWP-luluc	kg CO_2-eq.	2.29E-01	4.02E-05	8.02E-02
Depletion Potential of the Stratospheric Ozone Layer	ODP	kg CFC-11-eq.	1.00E-05	1.21E-05	1.14E-05
Acidification potential	AP	mol H^+-eq.	2.93E+00	2.58E+00	2.73E+00
Eutrophication potential - freshwater	EP-freshwater	kg P-eq.	3.83E-02	1.22E-04	1.35E-02
Eutrophication potential - marine	EP-marine	kg N-eq.	7.02E-01	5.21E-01	5.91E-01
Eutrophication potential - terrestrial	EP-terrestrial	mol N-eq.	8.01E+00	5.78E+00	6.63E+00
Formation potential of tropospheric ozone	POCP	kg NMVOC-eq.	1.98E+00	1.45E+00	1.66E+00
Abiotic depletion potential for non-fossil resources*	ADP-minerals & metals	kg Sb-eq.	1.71E-05	2.83E-06	7.83E-06
Abiotic depletion potential for fossil resources*	ADP-fossil	MJ	4630	2000	2990
Water (user) deprivation potential*	WDP	m^3world-eq. deprived	179	236	218

*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.

Table 4: Potential environmental impacts – additional indicators according to EN 15804:2012+A2:2019

Indicator	Abbreviation	Units	Bulk GP cement ex Naval Base	Bulk milled slag ex Naval Base	Bulk low heat ex Naval Base
Particulate Matter emissions	PM	Disease incidence	2.06E-05	7.12E-06	1.24E-05
Ionising Radiation - human health **	IRP	kBq U-235-eq.	1.14E+00	4.33E-03	4.02E-01
Eco-toxicity - freshwater*	ETP-fw	CTUe	4440	713	2020
Human toxicity potential - cancer effects*	HTP-c	CTUh	5.70E-08	3.01E-08	4.00E-08
Human toxicity potential - non-cancer effects*	HTP-nc	CTUh	4.75E-06	1.27E-06	2.52E-06
Land use related impacts / soil quality*	SQP	-	421	130	468

*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.
**Disclaimer: This impact category deals mainly with the eventual impact of low dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator.

Table 5: Use of Resources

Indicator	Abbreviation	Units	Bulk GP cement ex Naval Base	Bulk milled slag ex Naval Base	Bulk low heat ex Naval Base
Use of renewable primary energy excluding renewable primary energy	PERE	MJ	1.99E+02	3.35E+01	9.59E+01
Use of renewable primary energy resources used as raw materials	PERM	MJ	0.00E+00	0.00E+00	0.00E+00
Total use of renewable primary energy resources	PERT	MJ	1.99E+02	3.35E+01	9.59E+01
Use of non-renewable primary energy excluding non-renewable primary	PENRE	MJ	5.20E+03	2.06E+03	3.23E+03
Use of non-renewable primary energy resources used as raw materials	PENRM	MJ	0.00E+00	0.00E+00	0.00E+00
Total use of non-renewable primary energy resources	PENRT	MJ	5.20E+03	2.06E+03	3.23E+03
Use of secondary material	SM	kg	1.58E+01	1.01E+03	6.59E+02
Use of renewable secondary fuels	RSF	MJ	1.10E+02	0.00E+00	3.86E+01
Use of non-renewable secondary fuels	NRSF	MJ	2.58E+02	0.00E+00	9.03E+01
Net use of fresh water	FW	m^3	3.81E+01	5.02E-01	1.37E+01

Table 6: Waste Production

Indicator	Abbreviation	Units	Bulk GP cement ex Naval Base	Bulk milled slag ex Naval Base	Bulk low heat ex Naval Base
Hazardous waste disposed	HWD	kg	0.00E+00	0.00E+00	0.00E+00
Non-hazardous waste disposed	NHWD	kg	1.69E-01	1.82E-01	1.88E-01
Radioactive waste disposed	RWD	kg	0.00E+00	0.00E+00	0.00E+00

Table 7: Output Flows

Indicator	Abbreviation	Units	Bulk GP cement ex Naval Base	Bulk milled slag ex Naval Base	Bulk low heat ex Naval Base
Components for re-use	CRU	kg	0.00E+00	0.00E+00	0.00E+00
Materials for recycling	MFR	kg	0.00E+00	0.00E+00	0.00E+00
Materials for energy recovery	MER	kg	0.00E+00	0.00E+00	0.00E+00
Exported energy - electrical and thermal	EE	MJ	0.00E+00	0.00E+00	0.00E+00

Life Cycle Assessment (LCA) Results

Table 8: Potential environmental impacts – mandatory indicators according to EN 15804:2012+A1:2013

Indicator	Abbreviation	Units	Bulk GP cement ex Naval Base	Bulk milled slag ex Naval Base	Bulk low heat ex Naval Base
Global warming potential	GWP	kg CO_2-eq.	1040	144	462
Ozone depletion potential	ODP	kg CFC-11-eq.	7.99E-06	9.59E-06	9.05E-06
Acidification potential	AP	kg SO_2-eq.	2.21	1.98	2.07
Eutrophication potential	EP	kg PO_4^{3-}-eq.	0.364	0.179	0.246
Photochemical ozone creation potential	POCP	kg C_2H_4-eq.	0.136	0.107	0.118
Abiotic depletion potential for non-fossil resources	ADPE	kg Sb-eq.	1.72E-05	2.83E-06	7.85E-06
Abiotic depletion potential for fossil resources	ADPF	MJ_{NCV}	6380	1970	3580

Table 9: Carbon footprint in line with Australian climate change reporting frameworks

Indicator	Abbreviation	Units	Bulk GP cement ex Naval Base	Bulk milled slag ex Naval Base	Bulk low heat ex Naval Base
Global Warming Potential - Greenhouse Gas emissions	GWP-GHG	kg CO_2-eq.	1040	144	463

The GWP-GHG indicator includes all greenhouse gases included in GWP-total but excludes biogenic carbon dioxide uptake and emissions and biogenic carbon stored in the product as defined by IPCC AR5 (IPCC 2013). This indicator is determined using IPCC AR5 Global Warming Potentials (GWP) with a 100-year time horizon.

Program Information and Verification

An Environmental Product Declaration (EPD) is a standardised way of quantifying the potential environmental impacts of a product or system. EPDs are produced according to a consistent set of rules – Product Category Rules (PCR) – that define the requirements within a given product category. These rules are a key part of ISO 14025 as they enable transparency and comparability between EPDs.

This EPD provides environmental indicators for BGC Cement's cementitious products produced at its Naval Base site in Western Australia. This EPD is a "cradle-to-gate" declaration covering production of the cementitious products and their supply chain.

This EPD is verified to be compliant with EN 15804+A2. EPDs of construction products may not be comparable if they do not comply with EN15804. EPDs within the same product category but from different programs or utilising different standards or PCRs may not be comparable.

As the EPD owner, BGC Cement has the sole ownership, liability, and responsibility for the EPD.

Declaration Owner	BGC Cement	BGC Cement	Address: 32 Beard Street, Naval Base WA 6165, Australia Web: www.bgccement.com.au Phone: 08 9334 4555 Email: cement@bgc.com.au
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CEN standard EN 15804:2012+A2:2019 served as the core PCR	
PCR:	PCR 2019:14 Construction Products, Version 1.11, 2021-02-05 (valid until 2024-12-20) c-PCR-001 Cement and Building Lime (EN 16908:2017), 2019-12-20 (valid until 2024-12-20)
PCR review was conducted by:	The Technical Committee of the International EPD® System. Chair: Claudia A. Peña Contact via info@environdec.com
Independent verification of the declaration and data, according to ISO 14025:	◯ EPD process certification (Internal) ⊘ EPD verification (External)
Procedure for follow-up of data during EPD validity involves third-party verifier:	◯ Yes ⊘ No

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