EN 15804+A2 EPD

ENVIRONMENTAL PRODUCT DECLARATION

as per ISO 14025 and EN 15804 + A2
Owner of the Declaration –
Cement Manufacturers Ireland

Declaration number: EPDIE-21-52
Issue date 11.03.2022
Valid to 11.03.2027

CEM I
Portland cement

EPD Programme - EPD Ireland
Programme Operator - Irish Green Building Council
www.epdireland.org

1. General information

PROGRAMME OPERATOR	OWNER OF DECLARATION
Irish Green Building Council, 19 Mountjoy Square, Dublin D01 E8P5	Cement Manufacturers Ireland, c/o IBEC 84/86 Lower Baggot Street, Dublin 2, D02 H720 www.cement.ie David.Howard@ibec.ie 01-6051500
DECLARATION NUMBER	**PRODUCTION SITE**
EPDIE-21-52	Breedon Cement Ireland Ltd, Kinnegad, Co. Westmeath, Irish Cement, Castlemungret, Co. Limerick, Irish Cement, Platin, Drogheda, Co. Louth, Mannok Cement, Ballyconnell, Co. Cavan.
ECO PLATFORM	**DECLARED UNIT**
yes	1 tonne of cement (CEM I – Portland cement) according to EN 197-1
APPLICABLE PRODUCT CATEGORY RULES	**DECLARED PRODUCT**
EN 15804:2012+A2:2019, EPD Ireland PCR Part A, PCR for cement and building lime, EN 16908:2017	CEM I (Portland cement)
DATE OF ISSUE	**SCOPE OF EPD**
11.03.2022	CEM I cement in accordance to EN 197-1
DATE OF EXPIRY	**LCA CONSULTANT OR PERSON RESPONSIBLE FOR LCA**
11.03.2027	VDZ Technology gGmbH, Toulouser Allee 71, 40476 Düsseldorf Germany
TYPE OF EPD :SINGLE OR MULTI PRODUCT	**LCA SOFTWARE AND DEVELOPER IF APPLICABLE**
Single	GaBi ts Software (version 10.0.0.71)
PRODUCT CLASSIFICATION OR NACE CODE	**NAME AND VERSION OF INVENTORY USED**
Manufacture of cement	Ecoinvent 3.5
COMPARABILITY	
The purpose of this EPD is to provide data to the construction industry to allow for the life cycle assessment of buildings and other construction works. The intended use of this EPD is for B2B communication. A comparison of EPD data is only meaningful if all the data sets compared are developed according to EN 15804 and the product-specific performance characteristics and its impact on the construction works are taken into account. The EPD owner has the sole ownership, liability, and responsibility for the EPD.	
This declaration is based on the European standand EN 15804:2012+A2:2019 and the PCR for cement, EN 16908:2017.	
In accordance with EN ISO 14025, it was verified by an external independent expert.	

Internally ☐ Externally **X**

SIGNATURE OF PROGRAMME OPERATOR	SIGNATURE OF VERIFIER
Pat Barry – CEO – Irish Green Building Council  IGBC IRISH GREEN BUILDING COUNCIL	Marcel Gómez Consultoria Ambiental  MARCEL GÓMEZ consultoria ambiental

2. Scope

This EPD covers the product stage modules A1 – A3 (raw material supply, transport, manufacturing of products), i.e. from cradle to gate. Cement is used in a multitude of possible construction applications which are beyond the scope of this EPD. The modules that are declared are shown in the table below.

The geographical area covered includes four cement manufacturing facilities in the Republic of Ireland.

PRODUCT STAGE			CONSTRUCTION ON PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARIES
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse – Recovery – Recycling potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

X - Module declared.

ND - Module not declared.

Declared Unit

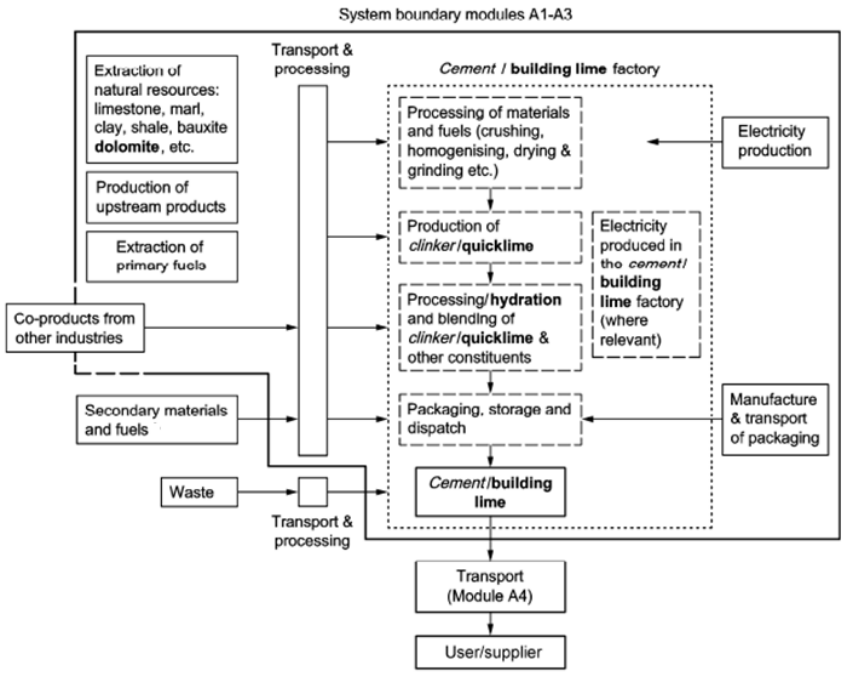
The declared unit is 1 tonne of cement (CEM I – Portland cement) according to EN 197-1.

Note that this is a weighted average based on the total production volume at the 4 cement facilities.

System boundaries

Life cycle stages/system boundaries:
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.
The following figure shows the system boundaries, in accordance with EN 16908:2017, Figure 1:



The product stage contains:

Module A1: extraction and processing of raw materials and primary fuels
Module A2: transportation up to the factory gate and internal transports
Module A3: cement production

3. Detailed product description

Cement product:

The Central Product Classification (CPC) for cement is CPC 37440. Cement is a hydraulic binder i.e., a finely ground inorganic material which, when mixed with water, forms a paste which sets and hardens by means of hydration reactions and processes and which, after hardening, retains its strength and stability even under water. Cement is mainly used as a binder for concrete, mortar or cement screed. The members of the Cement Manufacturers of Ireland operate four cement manufacturing facilities in the Republic of Ireland.

Main product components:

Cement according to EN 197-1 is produced by grinding and mixing the constituents defined in the standard.

Constituents of cement as defined in EN 197-1 are,

- main constituents (portland cement clinker and e.g. limestone)
- minor additional constituents (added to improve the physical properties of the cement, such as workability or water retention)
- calcium sulfate (natural gypsum, added to control setting)
- additives (the total quantity of additives shall not exceed 1,0% by mass of the cement)

The main constituent of CEM I cement is clinker.

Based on the data provided by all members of Cement Manufacturers Ireland, the following CEM I cement composition was assumed for the LCA model:

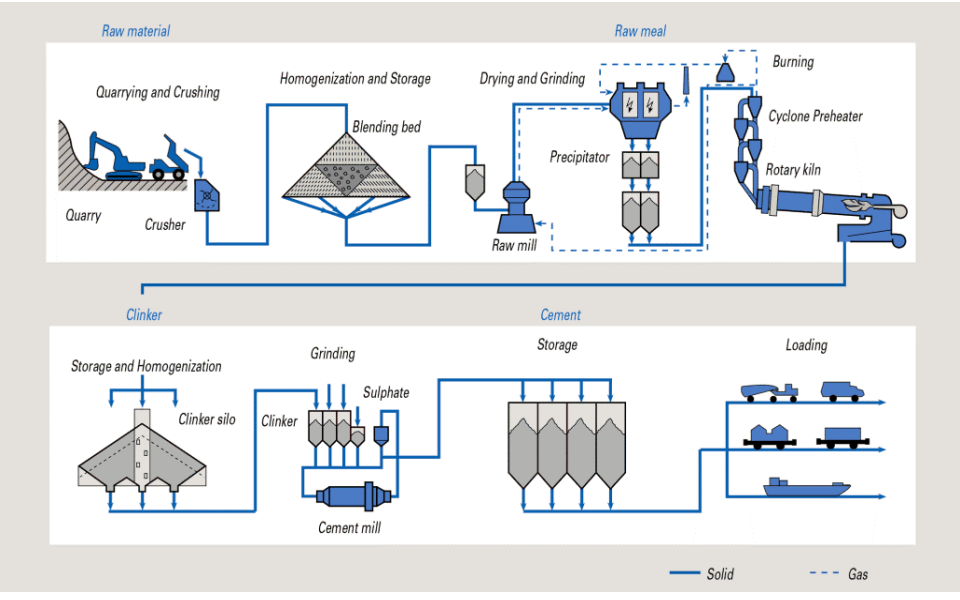
Portland cement clinker	912 kg/t
Limestone	45 kg/t
Calcium sulphate	40 kg/t
Other (chromate reducing agents, filter dust)	3 kg/t
Total	1000 kg/t

3.1 Manufacturing Process Description

The most important component of cement according to EN 197-1 is clinker. It is produced from raw materials such as limestone and clay which are crushed, homogenized and fed into a rotary kiln. The raw materials are sintered at a temperature of 1450°C to form new compounds. Clinker consists mainly of calcium, silicon, aluminium and iron-oxides.

In a second phase of manufacturing, calcium sulphates and additional materials are added to the clinker. All constituents are ground together leading to a fine and homogenous powder.

The following figure is a schematic representation of the cement manufacturing process from quarry to dispatch (production stage, information modules A1 to A3).



4. LCA results

CEM I (Portland cement)

Core environmental impact indicators per t

PARAMETER	UNIT	MODULES A1-A3	MODULES A4-D
GWP Total	[kg CO_2 eq.]	763.27	ND
GWP fossil	[kg CO_2 eq.]	763 *1)	ND
GWP biogenic	[kg CO_2 eq.]	0.16 *2)	ND
GWP luluc	[kg CO_2 eq.]	0.11	ND
ODP	[kg CFC-11 eq.]	1.32E-05	ND
AP	[mol H+ eq.]	1.48	ND
EP-freshwater	[kg P eq.]	0.0166	ND
EP-marine	[kg N eq.]	0.452	ND
EP-terrestrial	[mol N eq.]	5.16	ND
POCP	[kg NMVOC eq.]	1.25	ND
ADP-minerals & metals	[kg Sb eq.]	8,82E-5*3)	ND
ADP-fossils	[MJ] ncv	2170 *3)	ND
WDP	[m3 world- eq. deprived]	11.6 *3)	ND

GWP-total = Global Warming Potential total; GWP-fossil= Global Warming Potential fossil fuels (GWP-fossil; GWP-biogenic= Global Warming Potential biogenic; GWP-luluc= Global Warming Potential land use and land use change; ODP = Depletion potential of the stratospheric ozone layer; AP =Acidification potential, Accumulated Exceedance; EP-freshwater = Eutrophication potential, fraction of nutrients reaching freshwater end compartment; EP-marine: Eutrophication potential, fraction of nutrients reaching marine end compartment; EP-terrestrial: Eutrophication potential, Accumulated Exceedance; POCP = Formation potential of tropospheric ozone; ADP-minerals&fossils = Abiotic depletion potential for non-fossil resources; ADP-fossils= Abiotic depletion potential for fossil resources; WDP: Water (user) deprivation potential, deprivation-weighted water consumption. ND = Module not declared.

LCA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks

**1) According to the polluter pays principle, the system that generates the waste is responsible for declaring the impacts of waste processing until the end. of waste stage is reached. The indicated value (net value) therefore does not include the CO_2 - emissions from waste-derived fuel combustion. The gross value (including 48 kg CO_2 – eq from the combustion of the fossil portion of waste-derived fuels) is 811 kg CO_2 - eq./t cement.*

**2) The indicated value does not include biogenic CO_2 - emissions from the combustion of waste-derived fuels. The GWP from these biogenic CO_2 – emissions is 32 kg CO_2 - eq./t cement.*

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

4. LCA results

CEM I (Portland cement)

Resource use per t

PARAMETER	UNIT	MODULES A1-A3	MODULES A4-D
PERE	[MJ]	145	ND
PERM	[MJ]	0	ND
PERT	[MJ]	145	ND
PENRE	[MJ]	2170	ND
PENRM	[MJ]	0	ND
PENRT	[MJ]	2170	ND
SM	[kg]	12.3	ND
RSF	[MJ]	375	ND
NRSF	[MJ]	565	ND
FW	[m^3]	0.22	ND

PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used as raw materials; PENRT = Total use of non-renewable primary energy resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water. ND = Module not declared.

LCA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks.

4. LCA results

CEM I (Portland cement)

Output flows and waste categories per t

PARAMETER	UNIT	MODULES A1-A3	MODULES A4-D
HWD	[kg]	0	ND
NHWD	[kg]	0	ND
RWD	[kg]	0	ND
CRU	[kg]	0	ND
MFR	[kg]	0	ND
MER	[kg]	0	ND
EE	[MJ]	0	ND

HWD = Hazardous waste disposed; NHWD = Non-hazardous waste disposed; RWD = Radioactive waste disposed; CRU = Components for re-use; MFR = Materials for recycling; MER = Materials for energy recovery; EE = Exported energy; ND - Module not declared.

LCA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks.

5. LCA results

CEM I (Portland cement)

Additional environmental impact indicators per t

PARAMETER	UNIT	MODULES A1-A3	MODULES A4-D
PM	Disease incidence	6.31E-06	ND
IRP	kBq U235 eq	8.91*1)	ND

PM= Potential incidence of disease due to PM emissions, IRP = Potential Human exposure efficiency relative to U235, ND = Module not declared.

LCA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks.

**1) This impact category deals mainly with the eventual impact of low dose ionizing radiation on human health of the nuclear fuelcycle. 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.*

5 Calculation rules

The members of the Cement Manufacturers of Ireland operate four cement manufacturing facilities in the Republic of Ireland.

Production data in the year 2019 for all four manufacturing facilities were confidentially aggregated to obtain an industry average data set. During the LCA modelling, this average data (raw materials, fuels, emissions, transport distances) was used.

The "GaBi ts" Software (version 10.0.0.71) was used for the LCA in this project. The characterisation factors according to "Environmental Footprint 3.0" were used. In this study, the impact categories, indicators and methods given in EN 15804+A2:2019, are used.

Cut-off rules:

According to EN 15804, the cut-off criteria are 1% of renewable and non-renewable primary energy usage and 1% of the total mass input of that unit process. The total of neglected input flows per module, e.g. per module A1-A3, shall be a maximum of 5% of energy usage and mass.

No processes were excluded in this LCA study.

6 Data Quality

The data quality level for the specific data is assessed according to the criteria of the UN Environment Global Guidance on LCA database development. See table below with results on the geographical, technical and time representativeness.

GEOGRAPHICAL REPRESENTATIVENESS	TECHNICAL REPRESENTATIVENESS	TIME REPRESENTATIVENESS
Very good (data from area under study)	Very good (data from processes and products under study. Same state of technology applied as defined in goal and scope).	Very good (less than 3 years difference between the reference year according to the documentation, and the time period for which data are representative).

Assumptions:

Flows related to human activities such as employee transport are excluded. The construction of plants, production of machines and transportation systems are excluded since the related flows are considered negligible compared to the production of the manufactured product.

6 Scenarios and additional technical information

Declaration of biogenic carbon content at the production gate:

BIOGENIC CARBON PER DELCARED UNIT	UNIT	QUANTITY
Biogenic carbon content in product	[kg C]	0
Biogenic carbon content in packaging	[kg C]	0

7. Mandatory additional information on release of dangerous substances to indoor air, soil and water

None of the substances contained in the product are listed in the "Candidate List of Substances of Very High Concern for authorisation", or they do not exceed the limit for registration with the European Chemicals Agency.

8. Other optional additional environmental information

Chromate:

Prolonged physical contact with non-low chromate cements can cause allergic skin reactions. The REACH Regulation (EC 1907/2006) imposes requirements on the chromate content permissible for cement products. In line with this, only low chromate cements may now be used for the manufacture of concrete and mortar if the possibility of physical contact with these concretes and mortars during processing cannot be ruled out. The permissible chromate content is less than 2 ppm, or 2 grams per tonne.

Carbonation:

During and after the lifetime of concrete structures or other cement-containing products, hydrated cement contained within the product reacts with CO_2 in the air. Part of the CO_2 emitted during cement production is reabsorbed by the cement through carbonation, a reaction also referred to as cement carbonation. The quantity of CO_2 taken up will depend on the type of application and also its treatment after its lifetime. This reaction takes place mainly on the surface of cement-based products. Structural concrete applications are designed according to strict codes which ensure that carbonation at the concrete surface does not lead to corrosion of reinforcement. Carbonation can nevertheless be particularly relevant after demolition when the surface area in contact with air increases very significantly. Carbonation contributes to a reduced GWP impact of cement products over their whole life.

Since carbonation will depend on the application in question, please refer to the respective PCR/EPDs for ready-mix concrete, precast concrete, mortar, cement screed or other cement-based products.

Installation of cement:

Information on the safe and effective installation of cement can be obtained from the cement supplier.

9. References

EN 197-1:2011: Cement - part 1: Composition, specifications and conformity criteria for common cements.

ISO 14025:2011: Environmental labels and declarations — Type III environmental declarations - Principles and procedures.

EN 15804:2012+A2:2019: Sustainability of construction works — Environmental Product Declarations — Core rules for the product category of construction products.

EN 16908:2017: Cement and building lime - Environmental product declarations - Product Category Rules complementary to EN 15804.

VDZ Technology gGmbH – Background report "A-2019/1838 Environmental Product Declarations for CEM I and CEM II/A-L cements produced in the Republic of Ireland ", May 2021 (confidential, reviewed and approved by the third-party verifier).

General Programme Instructions for the International EPD® SYSTEM, version 3.01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