

CEMBUREAU Environmental Product Declaration for Cement

CEMBUREAU Portland cement (CEM I)

In compliance with
ISO 14020, ISO 14025
and ISO 14040-44

Aim and Scope

This Environmental Product Declaration (EPD) is mainly intended for Business-to-Business (B2B) communication and its prime purpose is to provide measurable and verifiable input for the environmental assessment of construction works.

As the applications of cement as an intermediate material are numerous, a unique *functional unit* cannot be defined and therefore this EPD is based on a *declared unit*.

This EPD has been specifically prepared for the cradle-to-gate life stages of cement.

This is illustrated in the figure hereafter.

See *Users' Guide* for more information.

Key information

Declared unit: 1 000 kg of cement

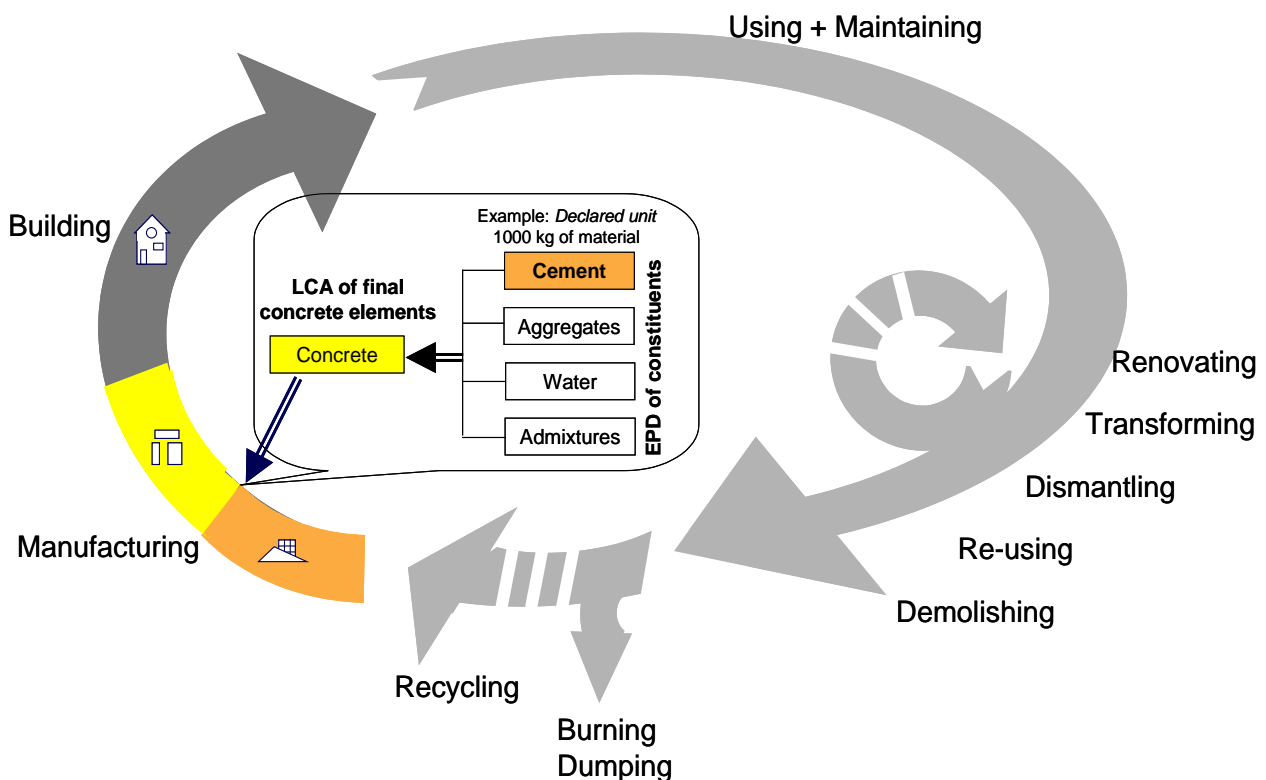
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This EPD includes information related to the cement manufacturing only

Cement production process and System boundaries

Production process

The main processes in cement production are:

- Quarrying and acquisition of material resources
- Production of raw mix
- Burning of clinker
- Grinding of cement
- Storage of cement / dispatch

Material resources

Natural raw materials for the clinker manufacture are in the first place calcareous materials like limestone or marl, sand and argillaceous materials like clay or shale, which are abundantly present in the earth. Alternative materials such as fly ash, blast furnace slag and other process residues may also be used as partial replacement for the natural raw materials.

Production of ground raw materials

Production of ground raw materials occurs by a wet or dry process. In the wet process a slurry of the raw materials is prepared prior to burning. The slurry is homogenised in basins and pumped to the wet long kiln. In the dry process, drying and grinding to the desired fineness of the raw mix usually takes place in one step in the raw mill. The residual heat of the flue gases of the kiln is utilised for drying.

Burning of clinker

The raw mix is preheated using the residual heat of the flue gases and burned in a rotary kiln at about 1450°C.

Major natural fuels used in the cement industry are coal, lignite and natural gas. The most important alternative fuels are derived from different types of waste. The percentage of alternative fuels varies highly within Europe.

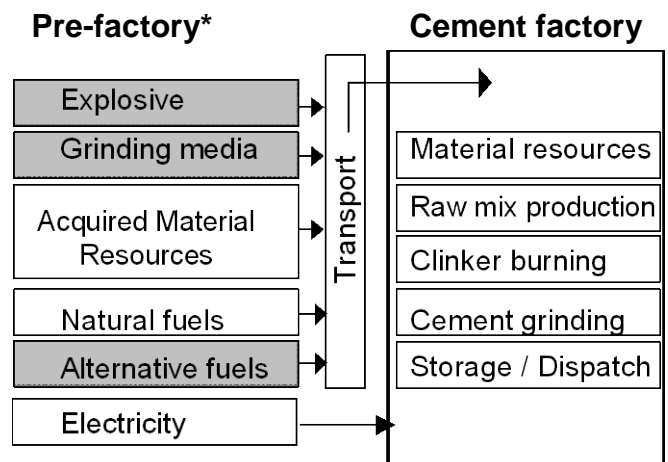
Grinding of cement

Finally, clinker is ground together with gypsum and possibly other constituents to produce cement.

System boundaries

The system boundaries are shown in the figure.

* Pre-factory: processes outside the cement factory boundary but still within the system boundaries.



■ * Pre-factory environmental issues/emissions are not included

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Use of resources without energy content: Raw materials

| | Pre-factory | Cement factory | Total | Comments |
|--|--------------------|-----------------------|--------------|-----------------|
| | kg/1000 kg | kg/1000 kg | kg/1000 kg | |
| Natural resources | | | | |
| Renewable* | 0 | 0 | 0 | |
| Non-renewable | 18 | 1447 | 1465 | |
| Secondary (alternative) resources | | | | |
| Renewable* | 0 | 0 | 0 | |
| Non-renewable | 0 | 44 | 44 | |
| Total | 18 | 1491 | 1509 | |

* If relevant

Note: The above-mentioned values do not include the water content of the materials.

Use of resources: Water

| | Pre-factory | Cement factory | Total | Comments |
|--------------|--------------------|-----------------------|--------------|-----------------|
| | kg/1000 kg | kg/1000 kg | kg/1000 kg | |
| Water | 1467 | 226 | 1693 | |

Use of resources with energy content

| Thermal energy MJ/1000 kg | Pre-factory | Cement factory | Total | Comments |
|--|--------------------|-----------------------|--------------|-----------------|
| Natural resources | | | | |
| Renewable | 132 | 0 | 132 | |
| Non-renewable | 1370 | 2501 | 3871 | |
| Secondary (alternative) resources | | | | |
| Renewable | 0 | 157 | 157 | |
| Non-renewable | 0 | 638 | 638 | |
| Total | 1502 | 3296 | 4798 | |

Note: The above-mentioned values are related to the net calorific value.

Other indicators

The electricity consumption in the manufacturing process corresponds to 118 kWh per 1000 kg of cement.

Impact categories

| | Unit | Pre-factory | Cement factory | Total | Comments |
|--|---|-------------|----------------|----------|----------|
| Global warming | kg CO ₂ eq/1000 kg | 118 | 781 | 899 | |
| Acidification | kg SO ₂ eq/1000 kg | 1.1 | 1.3 | 2.4 | |
| Ozone depletion | kg CFC-11 eq/1000 kg | 0.000043 | 0 | 0.000043 | |
| Photochemical oxidant formation | kg C ₂ H ₄ eq/1000 kg | 0.13 | 0.12 | 0.25 | |
| Eutrophication | kg PO ₄ eq/1000 kg | 0.05 | 0.20 | 0.25 | |

Toxicity impact

- At present time, there are no internationally recognised models for the assessment of the toxicity impact.
- Whenever an accepted national model for the determination of the toxicity impact exists, it may be used.

Generated waste for disposal

| | Pre-factory | Cement factory | Total | Comments |
|----------------------------|-------------|----------------|------------|----------|
| | kg/1000 kg | kg/1000 kg | kg/1000 kg | |
| Non hazardous waste | 665 | not relevant | 665 | |
| Hazardous waste | 1.2 | not relevant | 1.2 | |

Note: Non-hazardous waste consists to a very large extent of waste heap. In very few cases minor amounts of bypass dust may occur in cement plants which have to be treated as waste.

Additional information

This EPD provides information concerning the production of cement only. This information can be used as an input for an assessment of a specific application of cements with regard to its entire life cycle, which also takes into account the beneficial contribution of cement to construction.

The production of cement is subject to National and European legislation, which address all relevant environmental effects like the excavation of natural raw materials, the rehabilitation of quarries, the recovery of energy and material from wastes and the emission of noise, dust and hazardous substances (NO_x, SO₂, heavy metals, etc.).

Cement addressed in this EPD must be in conformity with national or harmonized European standards as e.g. EN 197-1 Cement-Composition, specifications and conformity criteria for common cements. Harmonized European standards address all of the Essential Requirements of the European Construction Products Directive (89/106/EEC) including the Essential Requirement on Hygiene, Health and the Environment. Also the use of cement in mortar and concrete is specified in corresponding national and/or European standards, which also take into account existing relevant National Regulations and European Directives addressing "Regulated Substances" in construction products.

Environmental Product Declarations will play a crucial role as Business-to-Business communication tool in the Integrated Product Policy (IPP) strategy of the European Union and as a major element of the standardisation, mandated by the EU Commission to CEN, of the assessment of the Environmental Performance of Buildings. For that purpose, it is necessary to use specific calculation software, which integrates the environmental impacts of all the components of the building covering each phase of its life. This calculation methodology however is not yet standardised at European or international levels. See *Users' Guide for more information on this topic*.

Safety data sheets of cements are available which provide information concerning the use of cements at the place of work. According to the Regulation (EC) 1907/2006 of 18 December 2006 safety data sheets are intended for use by professional users and must enable them to make the necessary measures as regards the protection of health, safety and environment at the place of work.

Please note that environmental declarations from different programme operators may not be comparable.

Additional references

PCR review was conducted by:

The Technical Committee (TC) of the international EPD® system
You may contact the TC through CEMBUREAU (epd@cembureau.eu)

Independent verification of the declaration and data, according to ISO 14025:2006

internal *external*

Third party verifier:

Johannes Kreißig, PE INTERNATIONAL GmbH

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|-----------------------|---|
| <u>ISO 14025:2006</u> | Environmental labels and declarations -- Type III environmental declarations |
| <u>ISO 14040:2006</u> | Environmental management -- Life cycle assessment -- Principles and framework |
| <u>ISO 14044:2006</u> | Environmental management -- Life cycle assessment – Requirements and Guidelines |
| WBCSD | www.wbcscement.org - Information on LCA tools for the cement industry. |
| PCR for cement | www.environdec.com - PRODUCT CATEGORY RULES (PCR) for preparing an environmental product declaration (EPD) for Product Group "Cement" (final version 06-04-03) |
| Verification Report | Verification Report on the CEMBUREAU Environmental Product Declaration for Portland cement (CEM I) (based on report TR-ECRA 0183-5/2007) by Johannes Kreißig, PE INTERNATIONAL GmbH (date: 23 January 2009) |