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The Norwegian EPD Foundation

ENVIRONMENTAL PRODUCT DECLARATION

in accordance with ISO 14025, ISO 21930 and EN 15804

Owner of the declaration:	Cemex AS
Program operator:	The Norwegian EPD Foundation
Publisher:	The Norwegian EPD Foundation
Declaration number:	NEPD-359-235-EN
Issue date:	13.10.2015
Valid to:	13.10.2020

Cemex Hvitsement, CEM I 52,5 R

Cemex AS

www.epd-norge.no

General information

Product:
Cemex Hvitsement, CEM I 52,5 R

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Declaration number:
NEPD-359-235-EN

Place of production:
Plant Buñol, Spain

ECO Platform reference number:
-

Management system:
ISO 14001: GA-1999/0030

This declaration is based on Product Category Rules:
CEN Standard EN 15804 serves as core PCR

Organisation no:
No: 954 799 212
ES: B85771269

Statement of liability:
The owner of the declaration shall be liable for the underlying information and evidence. EPD Norway shall not be liable with respect to manufacturerinformation, life cycle assessment data and evidences.

Issue date:
13.10.2015

Valid to:
13.10.2020

Declared unit:
1 tonne cement, A1-A3. Cradle to Gate
+ A4 Transport to Norway

Year of study:
2015

Declared unit with option:

Comparability:
EPD of construction products may not be comparable if they not comply with EN 15804 and seen in a building context.

Functional unit:

The EPD has been worked out by:
Mie Vold

Østfoldforskning

Verification:
The CEN Norm EN 15804 serves as the core PCR. Independent verification of the declaration and data, according to ISO14025:2010

☐ internal ☑ external

Third party verifier:
Erik Svanes
Research Scientist, Erik Svanes
(Independent verifier approved by EPD Norway)

Approved
Håkon Hauan
Managing Director of EPD-Norway

Product

Product description:
Cemex Hvitsement, CEM I 52,5 R is a white Portland cement. This construction material is used primarily in architectural concrete works requiring great brightness and artistic finishes, white or colored renderings, mortars, and high-end precast concrete products.

Product specification:
The cement consist of clinker, limestone (unburned) and gypsum. Clinker is burned limestone with small quantities of sand, kaolin and CaF_2 (secondary material)

Materials in white cement	kg/tonne cement	%
Clinker (burned limestone)	926,2	92,6
Limestone	25,2	2,5
Gypsum	48,6	4,9
Packaging (paperbags)	15	

Technical data:
1000 kg cement (Cem I 52,5)
Declarations and other technical information can be downloaded from www.cemex.no

Market:
Norway

Reference service life, product:
Not relevant

Reference service life, building:
Not relevant

LCA: Calculation rules

Declared unit:
1 tonne cement, A1-A3. Cradle to Gate
+ A4 Transport to Norway

System boundary:
1 tonne of cement from raw material extraction to factory gate

Production of cement:
1. Mining the raw material
Limestone is extracted from rock quarries by boring the rock and setting off explosives with a negligible impact of the environment, due to the modern technology employed.
2. Transporting the raw material
Once the huge rocks have been fragmented, they are transported to the plant in dump trucks or by conveyor belt. This step also include transport of other raw materials.
3. Crushing
The quarry stone is delivered through chutes to the crushers, where it is reduced by crushing or pounding to chunks approximately 1 ½ inches in size.
4. Prehomogenization
Prehomogenization is the proportional mix of the different types of clay, limestone, or any other required material.
5. Raw material storage
Each of the raw materials is transported separately to silos, where they later are added in specific amounts according to the particular type of cement being produced.
6. Raw meal mill
Raw material milling takes places in vertical steel mill, which grinds the material through the pressure exerted by three conical rollers. These roll over a turning milling table. Horizontal mills, inside which the material is pulverized by means of steel balls, are also used in this phase.
7. Calcination
Calcination is the core portion of the process, in which huge rotary kilns come into play. Inside, at 1400 degrees C, the raw material is transformed into clinker: small, dark grey nodules 3-4 centimetres in diameter.
8. Cement milling
The clinker is ground by different-size steel balls while it works its way through the mill's two chambers, with gypsum being added to extend cement setting times. Ashes, furnace slag and limestone, gypsum are also added to the clinker.

Figure 1 shows a flow chart of process included in the different life cycle modules declared in the declaration

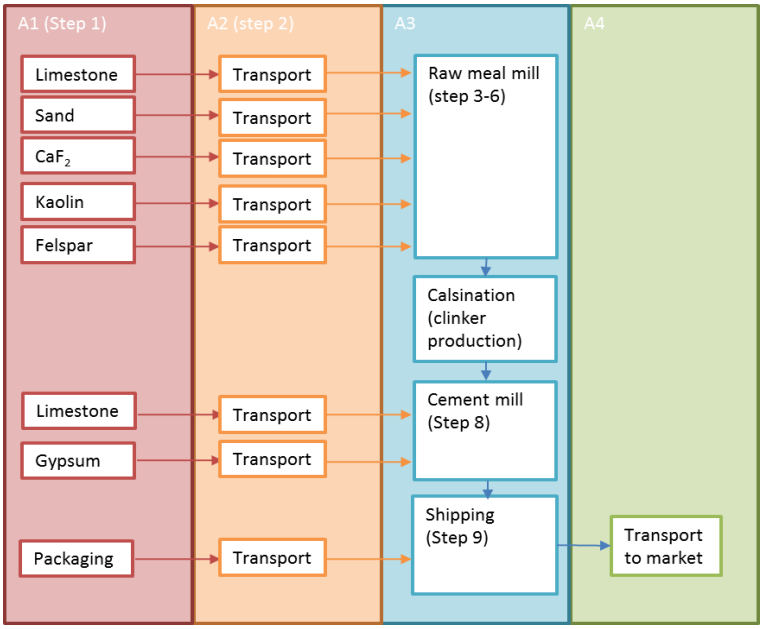

Figure 1: Flow chart

9. Cement packaging and shipping
The cement is then housed in storage silos, from where it is hydraulically or mechanically extracted and transported to facilities where it will be packaged in sacks or supplied in bulk. In either case, it can be shipped by freighter truck and ship.

Data quality:

Raw material group	Data quality	Data Source and allocation methode	Age of data
Limestone	Specific data	Factory measurements, mass allocated	2014
Sand	Østfoldforsknings database	Sand, at mine - production with UCTE el mix	2010
CaF2	Assumed scondary material	Quantities are small	
Kaolin	EcoInvent 3.1. Data with large unsertainty, but quantities under cut-off	Kaolin {RER}| production | Alloc Rec, U	2014
Feldspar	EcoInvent 3.1. Data with large uncertainty, but quantities under cut-off	Sodium silicate, solid {RER}| sodium silicate production, furnace process, solid product | Alloc Rec, U is assumed to be representative as quantivies are small	2014
Clinker	Specific data	Factory measurements, mass allocated	2013
Minral gypsum	EcoInvent 3.1	Allocated to main process where slag is produsedas	2006
Transports (raw materials)	Specific and database data	Spesific data for distances EcoInvent 3.1 for transport mode	Trucks, 2007 Boats, 2010
Transport to market	Specific data	Average data for fuel consumption at sea and in harbours for 5 boats used to transport Cemex cement EcoInvent used for fuel data (Assumed diesel for MGO)	2014

Allocation:

The allocation is made in accordance with the provisions of EN 15804. Incoming energy and water and waste production in-house is allocated equally among all products through mass allocation. Effects of primary production of recycled materials allocated to the main product in which the material was used. The recycling process and transportation of the material is allocated to this analysis.

Material	Allocation method	Allocation procedure	Justification
Secondary materials used as energy sources	Recycled content method.	Impacts allocated to first life cycle	Grinding emissions allocated to this product.
Raw meal mill	Mass allocation	Average per tonne based on yearly average emissions and production amount	Raw meal mill gives raw material for many products.
Clinker production			Clinker production gives raw material for many products.
Cement mill			All cement undergo roughly the same production flow hence average numbers are used for all cement products

Cut-off criteria:

All major raw materials and all the essential energy are included. The production process for raw materials and energy flows that are included with very small amounts (<1%) might not be reported and therefore not included. This cut-off rule does not apply to hazardous materials and substances.

LCA: Scenarios and additional technical information

The following information describe the scenarios in the different modules of the EPD.

Transport from production site to five sites in Norway; Oslo (A4a), Kristiansand (A4B), Randaberg (A4c), Etne (A4d) and Bergen (A4e). The transports include truck from the factory to Valencia and boat from Valencia to the different storage locations. Loading is the same for all, and an average of unloading is used for all destinations.

Transport from production place to user (A4)

Type	Capacity utilisation (incl. return) %	Type of vehicle	Distance km	Fuel/Energy consumption		Value (kg/t)*	
Truck, from Brunol to Valencia	Average utilisation (EcoInvent 3)	Transport, freight, lorry, unspecified {GLO}|	35	5,7E-02	l/tkm	2	l/t
Loading in Valencia (incl average Waiting)						0,4	kg/t
Unloading average, Norway (incl waiting)						0,3	kg/t
a) Boat to Oslo (A4-a)	50% (incl empty return) 3666 tonn, average full load (one way)	Average of KGJ Cement's boats	8 512	3,7E-03	kg/tkm	31	kg/t
b) Boat to Kristiansand (A4-b)			7 978			30	kg/t
c) Boat to Randaberg (A4-c)			8 104			30	kg/t
d) Boat to Etne (A4-d)			8 345			31	kg/t
e) Boat to Bergen (A4-e)			8 427			31	kg/t

LCA: Results

The declared unit is 1 tonne cement, A1-A3. Cradle to Gate + A4 Transport to Norway

System boundaries (X=included, MND= module not declared, MNR=module not relevant)

Product stage			Assemby stage		Use stage							End of life stage				Beyond the system boundaries
Raw materials	Transport	Manufacturing	Transport	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	x													

Environmental impact

Parameter	Unit	A1	A2	A3	A4				
					a) to Oslo	b) to Kr.sand	c) to Randaberg	d) to Etne	d) to Bergen
GWP	kg CO_2-eq	42	13	1 154	7,6	7,7	7,9	7,7	7,7
ODP	kg CFC11-eq	5,93E-06	2,55E-06	3,09E-05	1,39E-06	1,39E-06	1,44E-06	1,41E-06	1,41E-06
POCP	kg C_2H_4-eq	9,63E-03	2,31E-03	0,14	1,50E-03	1,50E-03	1,56E-03	1,51E-03	1,51E-03
AP	kg SO_2-eq	0,07	0,01	0,56	1,05E-02	1,05E-02	1,10E-02	1,06E-02	1,06E-02
EP	kg PO_4^{3-}-eq	0,22	0,05	2,35	0,05	0,05	0,05	0,05	0,05
ADPM	kg Sb-eq	8,34E-05	2,54E-05	2,25E-04	0,00	0,00	0,00	0,00	0,00
ADPE	MJ	572	205	4 110	111,77	112,13	116,02	113,02	113,03

GWP Global warming potential; ODP Depletion potential of the stratospheric ozone layer; POCP Formation potential of tropospheric photochemical oxidants; AP Acidification potential of land and water; EP Eutrophication potential; ADPM Abiotic depletion potential for non fossil resources; ADPE Abiotic depletion potential for fossil resources

Resource use

Parameter	Unit	A1	A2	A3	A4				
					a) to Oslo	b) to Kr.sand	c) to Randaberg	d) to Etne	d) to Bergen
RPEE	MJ	55	3	982	1,2	1,2	1,2	1,2	1,2
RPEM	MJ	13	1	462	0,33	0,33	0,33	0,33	0,33
TPE	MJ	67,8	4,2	1 444	2	2	1,58	1,56	1,56
NRPE	MJ	659	212	4 645	115	116	120	116	117
NRPM	MJ	-	-	-	-	-	-	-	-
TRPE	MJ	659	212	4 645	115	116	120	116	117
SM	kg	5,9	-	-	-	-	-	-	-
RSF	MJ	-	-	1 346	-	-	-	-	-
NRSF	MJ	-	-	1 606	-	-	-	-	-
W	m^3	1,9	0,05	1,7	4,0E-02	2,0E-02	2,1E-02	2,0E-02	2,0E-02

RPEE Renewable primary energy resources used as energy carrier; RPEM Renewable primary energy resources used as raw materials; TPE Total use of renewable primary energy resources; NRPE Non renewable primary energy resources used as energy carrier; NRPM Non renewable primary energy resources used as materials; TRPE Total use of non renewable primary energy resources; SM Use of secondary materials; RSF Use of renewable secondary fuels; NRSF Use of non renewable secondary fuels; W Use of net fresh water

End of life - Waste

Parameter	Unit	A1	A2	A3	A4				
					a) to Oslo	b) to Kr.sand	c) to Randaberg	d) to Etne	d) to Bergen
HW	kg	6,89E-04	1,23E-04	5,74E-02	6,23E-05	6,25E-05	6,42E-05	6,29E-05	6,29E-05
NHW	kg	14	21	125	5,09	5,10	5,12	5,10	5,10
RW	kg	INA	INA	INA	INA	INA	INA	INA	INA

HW Hazardous waste disposed; NHW Non hazardous waste disposed; RW Radioactive waste disposed

End of life - Output flow

Parameter	Unit	A1	A2	A3	A4				
					a) to Oslo	b) to Kr.sand	c) to Randaberg	d) to Etne	d) to Bergen
CR	kg	-	-	-	-	-	-	-	-
MR	kg	-	-	0,47	-	-	-	-	-
MER	kg	-	-	-	-	-	-	-	-
EEE	MJ	-	-	-	-	-	-	-	-
ETE	MJ	-	-	-	-	-	-	-	-

CR Components for reuse; MR Materials for recycling; MER Materials for energy recovery; EEE Exported electric energy; ETE Exported thermal energy

Reading example: 9,0 E-03 = $9,0*10^{-3}$ = 0,009

Additional Norwegian requirements

Greenhous gas emission from the use of electricity in the manufacturing phase
National production mix from import, low woltage (production of transmission lines, in addition to direct emissions and losses in grid) of applied electricity for the manufacturing prosess(A3).

Data source	Amount	Unit
Econinvent v3.1 (October 2014), Spanish El-mix	135	g CO_2-eq/MJ

Dangerous substances

☑ The product contains no substances given by the REACH Candidate list or the Norwegian priority list

☐ The product contains substances given by the REACH Candidate list or the Norwegian priority list that are less than 0,1 % by weight.

☐ The product contain dangerous substances, more then 0,1% by weight, given by the REACH Candidate List or the Norwegian Priority list, see table.

☐ The product contains no substances given by the REACH Candidate list or the Norwegian priority list. The product is classified as hazardous waste (Avfallsforskiften, Annex III), see table.

Name	CAS no.	Amount

Indoor environment
No tests have been carried out on the product concerning indoor climate - Not relevant

Carbon footprint
Carbon footprint has not been worked out for the product.

Bibliography

ISO 14025:2010 — *Environmental labels and declarations - Type III environmental declarations - Principles and procedures*

ISO 14044:2006 — *Environmental management - Life cycle assessment - Requirements and guidelines*

EN 15804:2012+A1:2013 — *Sustainability of construction works - Environmental product declaration - Core rules for the product category of construction products*

ISO 21930:2007 — *Sustainability in building construction - Environmental declaration of building products*

Vold, M, 2015 — Life Cycle Data for production of Cemex White Cement - Cem I 52,5 R , Background data for Environmental Product Declaration (EPD), OR 05.15., Østfoldforskning, Fredrikstad 2015

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