Environmental Product Declaration

CalPortland Company

Oro Grande Plant

- Type IL cement
- Riverside Type I/II/V cement
- Riverside Type III cement
- Riverside Plastic cement

NRMCA Certified Environmental Product Declaration

This environmental product declaration was conducted in accordance with ISO 14025:2006

☐ Internal Verification ☒ External Verification

Declared Product:	This is a business-to-business Type III environmental product declaration for cement manufactured by CalPortland in Oro Grande, California.	
Declaration Owner:	**CalPortland Company** 2025 East Financial Way Glendora CA 91741 www.calportland.com	CALPORTLAND®
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Product Category Rule:	ASTM International, Product Category Rules For Preparing an Environmental Product Declaration For Portland, Blended Hydraulic, Masonry, Mortar, and Plastic (Stucco) Cements. Chair of the Review Panel for the PCR: Nicholas Santero, thinkstep. Please contact ASTM International for communication with the Chair.	
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Period of Validity:	5 Years (until May 5, 2022)	
EPD Number	NRMCAEPD:10011	

Description of Company

CalPortland Company is a major diversified building materials and construction solutions provider to the Western United States and Canada. Since 1891, we have reliably provided quality innovative and efficient solutions to your greatest construction challenges with our expertise in cement production and distribution, ready mixed concrete, construction aggregates, asphalt, construction services and other building materials. Our products provide solutions everywhere; in buildings for shelter; roads and bridges that transport and link us; systems that provide electricity, water, gas and waste treatment; and other necessary infrastructure like hospitals, schools, railways and airports. We are creating solid foundations through the use of sustainable materials and renewable technologies.

CalPortland Company is the industry leader for energy conservation and environmental quality. Our commitment to continuously improve our environmental performance and provide positive contributions to our company and to society is a product of not just our words but also our actions. Sustainable development is defined as a society meeting the needs of the present without compromising the ability of future generations to meet their own needs. CalPortland is committed to solving tomorrow's challenges today through the advancement of sustainable materials and renewable technologies.

Product Identification

This EPD reports environmental information for Type IL blended hydraulic cement produced by CalPortland Company at their facility in Oro Grande, California. Type IL is a general use cement which includes a ground limestone content that is higher than permitted in Type I cement. Figure 1 below shows a visual representation of typical finished cement product.

Figure 1: Visual Representation of Typical Cement

Product Definitions

Cement, blended hydraulic: a hydraulic cement consisting of two or more inorganic constituents (at least one of which is not portland cement or portland cement clinker), which separately or in combination contribute to the strength gaining properties of the cement, (made with or without other constituents, processing additions and functional additions, by intergrinding or other blending). (ASTM C219)

ASTM C595 further defines the various types of blended cements, including:
Type IL – Portland-limestone cement – up to 15% limestone permitted

Product Standards

Applicable product standards for blended hydraulic cement (UN CPC 3744) include:

- ASTM C595 – Standard Specification for Blended Hydraulic Cements
- ASTM C1157 – Standard Performance Specification for Hydraulic Cement
- AASHTO M 240 – Standard Specification for Blended Hydraulic Cement
- CSA A3001 – Cementitious Materials for Use in Concrete

Material Contents

Table 1 presents the average material content by input material for the Type IL cement product, as derived from the facility LCI data for the year 2016.

Table 1: Average Material Content for Type IL Cement, kg per metric ton finished cement

Material Inputs	Quantity, kg per metric ton	% Contribution
Clinker	810	81.0%
Limestone	130	13.0%
Gypsum, natural	60	6.0%
Total	**1,000**	**100%**

Declared Unit

The declared unit is the basic reference flow set by the ASTM cement PCR: 2014 for the assessed products. The declared unit for this study is defined as one metric ton (1,000 kg), or optionally one short ton (2,000 lbs.), of cement.

Please note: only EPDs prepared from cradle-to-grave life-cycle results, and based on same function, reference service life, and quantified by the same functional unit, can be used to assist purchasers and users in making informed comparisons.

System Boundary

As per the ASTM PCR for cement, the system boundary is the product stage (i.e. "cradle-to-gate"), which includes the following modules:

- A1 Raw material supply;
- A2 Transport (to the manufacturer); and
- A3 Manufacturing.

Figure 2 shows the production stage system boundary for cement.

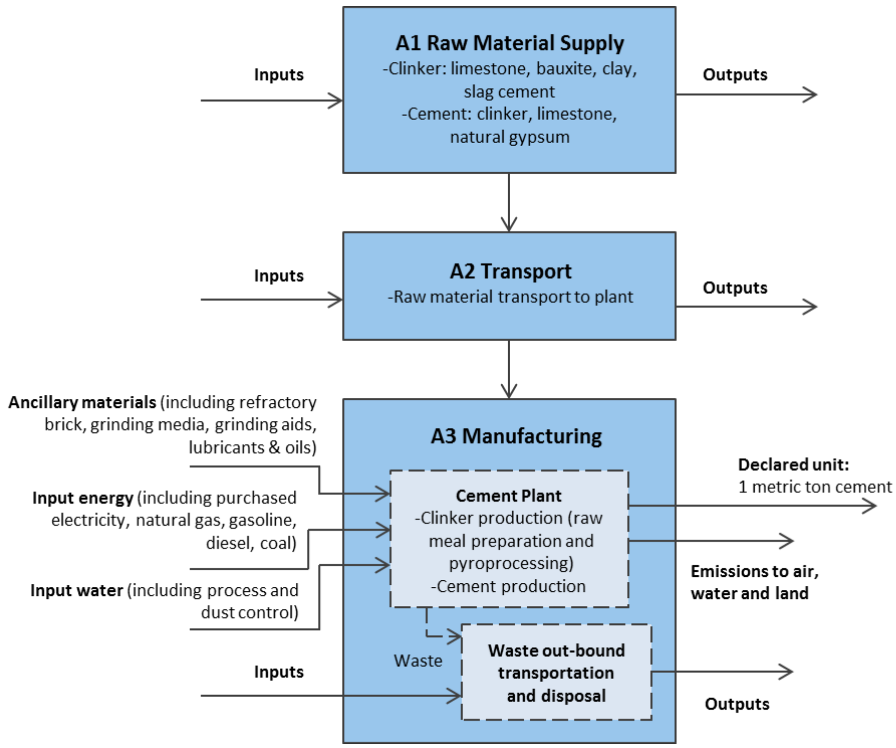

Figure 2: Cradle-to-gate System Boundary for Cement Production

Reference Service Life

The reference service life of cement is dependent on its end-use and therefore not declared herein.

Life Cycle Inventory

Primary LCI Data

Data collection was based on a survey of CalPortland's cement production facility operations. The following primary data was obtained for the 2016 calendar year:

- Clinker and finished cement raw material inputs;
- Clinker and cement production amounts;
- Inbound transportation distances and modes for raw materials, fuels, and ancillary materials;
- Grinding aids ancillary material use, water use;
- Electricity and fuel consumption;
- On-site process and fuel combustion air emissions (mobile equipment excluded);
- Waste outputs and outbound transportation distances and modes.

Secondary LCI Data

Secondary data was used for the following items within CalPortland's operational control:

- Facility water discharges and emissions;
- Ancillary materials (refractory brick, grinding media, oil & grease);
- Limestone quarry operations.

Table 2 on the following page is a summary of all secondary LCI data sources used to complete the LCA study.

Table 2: Secondary LCI Data Sources Summary

Item	Source
A1 - Raw Material Supply	
Limestone, bauxite	US LCI database
Clay	ecoinvent 3.1 database
Natural gypsum, slag cement	Athena LCI database
A2 - Transport	
Truck (diesel) & ocean (average fuel mix)	US LCI database
A3 - Manufacturing	
Ancillary materials, including refractory brick, grinding media & aids, oils & greases	ecoinvent 3.1 database
Purchased Electricity	Athena LCI database
Bituminous coal & natural gas extraction and processing; gasoline & diesel combustion	US LCI database
Water discharges	MIT Concrete Sustainability Hub (CSHub)
Water emissions	PCA EPD study
Outbound waste transport (truck, diesel)	US LCI database
Non-hazardous waste to landfill, Hazardous waste to incineration, hazardous waste to underground deposit	ecoinvent 3.1 database

Cut-off and Allocation

All input/output flow data reported by the facility were included in the LCI modelling.

Allocation procedures observed the requirements and guidance of ISO 14044:2006, clause 4.3. and those specified in ASTM PCR for cement, Section 7.5. Cement plant LCI environmental flows (inputs and outputs) were allocated according to mass of finished cement or mass of clinker in finished cement, as appropriate.

Data Quality

Data quality requirements, as specified in ASTM cement PCR: 2014, Section 7.3, were observed. This section describes the achieved data quality relative to the ISO 14044:2006 requirements.

Precision: CalPortland, through measurement and calculation, collected primary data on their production of cement. For accuracy the LCA team individually validated these plant gate-to-gate input and output data.

Completeness: All relevant, specific processes, including inputs and outputs were considered and modeled in SimaPro software v.8.3, April 2017.

Consistency: System boundaries, and allocation and cut-off rules have been uniformly applied across the product life cycles and the five cement products. The study predominantly relies on two sources of secondary data (US LCI and ecoinvent databases); adjustments were uniformly applied to all US LCI electricity, fuel, and transport processes. Crosschecks concerning the plausibility of mass and energy flows were continuously conducted.

Reproducibility: Internal reproducibility is possible since the data and the models are stored and available in Athena LCI database developed in SimaPro, 2017. A high level of transparency is provided throughout the supporting LCA report as the LCI profile is presented for the declared product. Key secondary (generic) LCI data sources are summarized in the LCA report.

Representativeness: The representativeness of the data is summarized as follows:

- Time related coverage: primary collected data for the cement manufacturing process: 2016, all secondary data has been validated within the past 9 years.
- Geographical coverage: the geographical coverage is the state of California.
- Technological coverage: typical or average.

Life Cycle Assessment

This section summarizes the results of the life cycle impact assessment (LCIA) based on the cradle-to-gate life cycle inventory inputs and outputs analysis. The results are calculated on the basis of one metric ton of cement and shown in Table 3; the results are also calculated on the basis of one short ton (2,000 lbs) and shown in Table 4.

As per ASTM PCR for cement, Section 8, US EPA Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts (TRACI, version 2.1) impact categories are used as they provide a North American context for the mandatory category indicators to be included in this EPD. These are relative expressions only and do not predict category impact end-points, the exceeding of thresholds, safety margins or risks. Total primary and sub-set energy consumption was compiled using a cumulative energy demand model. Material resource consumption and generated waste reflect cumulative life cycle inventory flow information.

Table 3: LCA Results – 1 metric ton Type IL cement

Category Indicator	Unit	Total A1-A3
TRACI 2.1 impact categories		
Global warming potential (GWP)	kg CO_2 eq.	871
Acidification potential	kg SO_2 eq.	1.56
Eutrophication potential	kg N eq.	0.0739
Smog creation potential	kg O_3 eq.	34.8
Ozone depletion potential	kg CFC-11 eq.	1.09E-06
Total primary energy consumption		
Non-renewable fossil	MJ (HHV)	5,010
Non-renewable nuclear	MJ (HHV)	136
Renewable (solar, wind, hydroelectric, and geothermal)	MJ (HHV)	136
Renewable (biomass)	MJ (HHV)	0.883
Material resources consumption		
Non-renewable material resources	kg	1,530
Renewable material resources	kg	0.0282
Net fresh water (inputs minus outputs)	l	335
Waste generated		
Non-hazardous waste generated	kg	2.59
Hazardous waste generated	kg	0.00658

Table 4: LCA Results – 1 short ton Type IL cement

Category Indicator	Unit	Total A1-A3
TRACI 2.1 impact categories		
Global warming potential (GWP)	kg CO_2 eq.	790
Acidification potential	kg SO_2 eq.	1.41
Eutrophication potential	kg N eq.	0.0670
Smog creation potential	kg O_3 eq.	31.6
Ozone depletion potential	kg CFC-11 eq.	9.93E-07
Total primary energy consumption		
Non-renewable fossil	MJ (HHV)	4,545
Non-renewable nuclear	MJ (HHV)	123
Renewable (solar, wind, hydroelectric, and geothermal)	MJ (HHV)	124
Renewable (biomass)	MJ (HHV)	0.801
Material resources consumption		
Non-renewable material resources	kg	1,388
Renewable material resources	kg	0.0255
Net fresh water (inputs minus outputs)	l	304
Waste generated		
Non-hazardous waste generated	kg	2.35
Hazardous waste generated	kg	0.00597

Additional Environmental Information

Table 5 reports two additional environmental indicators:

- Recovered materials sums the mass of recovered materials used in the cement formulations (i.e. the mass after processing has occurred);
- Respiratory effects is a TRACI 2.1 impact category.

Table 5: Additional Cradle-to-gate Environmental Indicator Results

Environmental Indicator	Unit	Total A1-A3
Recovered materials	kg	9.59
Respiratory effects	kg PM2.5 eq.	0.795

Declaration Type

The type of EPD based on the EPD project report is defined as "cradle-to-gate" EPD of cement covering the product stage (modules A1 to A3) and is intended for use in Business-to-Business communication.

Declaration Comparability Limitation Statement

The following ISO statement indicates the EPD comparability limitations and intent to avoid any market distortions or misinterpretation of EPDs based on the ASTM's Cement PCR: 2014:

- EPDs from different programs (using different PCR) may not be comparable.
- Declarations based on the ASTM Cement PCR are not comparative assertions; that is, no claim of environmental superiority may be inferred or implied.

References

ASTM International, Product Category Rules For Preparing an Environmental Product Declaration For Portland, Blended Hydraulic, Masonry, Mortar, and Plastic (Stucco) Cements, September 2014.

IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories, 2006.

ISO 14021:1999 Environmental labels and declarations -- Self-declared environmental claims (Type II environmental labelling)

ISO 14025: 2006 Environmental labeling and declarations - Type III environmental declarations - Principles and procedures.

ISO 14040: 2006 Environmental management - Life cycle assessment - Principles and framework.

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

ISO 21930: 2007 Building construction − Sustainability in building construction − Environmental declaration of building products.

NRMCA Program Operator Instructions For Environmental Product Declarations, November 2013.

MIT CSHub, Variation in the Life Cycle Inventory of Portland Cement Production in the US, 2010.

Marceau, M., Nisbet, M, & VanGeem, M. (2010). Life Cycle Inventory of Portland Cement Manufacture. Portland Cement Association R&D Serial No. SN2095b.02. Original 2006, revised 2010.

Quantis, Preparing industry average EPDs for cements produced in the United States. Life cycle inventories of portland, blended hydraulic, masonry and plastic (stucco) cements produced in the United States, April 2016

EPD Supplement: Riverside Cements

Product Identification

This EPD supplement reports environmental information for three additional hydraulic cements produced by CalPortland Company Inc. at their facility in Oro Grande, California:

1. Riverside Type I/II/V cement;
2. Riverside Type III cement;
3. Riverside Plastic cement.

Product Definitions

Portland cement: a hydraulic cement produced by pulverizing clinker, consisting essentially of crystalline hydraulic calcium silicates, and usually containing one or more of the following: water, calcium sulfate, up to 5% limestone, and processing additions. (ASTM C219)

ASTM C150 further defines the various types of portland cement, including:

- Type I: For use when the special properties specified for any other type are not required;
- Type II: For general use, more especially when moderate sulfate resistance or moderate heat of hydration is desired;
- Type III: For use when high early strength is desired; and
- Type V: For use when high sulfate resistance is desired.

Plastic cement: a hydraulic cement, primarily used in portland cement-based plastering construction, consisting of a mixture of portland or blended hydraulic cement and plasticizing materials (such as limestone or hydrated or hydraulic lime), together with other materials introduced to enhance one or more properties such as setting time, workability, water retention, and durability. (ASTM C1328)

Product Standards

Applicable product standards for portland cement include:

- ASTM C150 – Standard Specification for Portland Cement
- ASTM C1157 – Standard Performance Specification for Hydraulic Cement
- AASHTO M 85 – Standard Specification for Portland Cement (Chemical and Physical)
- CSA A3001 – Cementitious Materials for Use in Concrete

Applicable product standards for plastic cement include:

- ASTM C1328 – Standard Specification for Plastic (Stucco) Cement
- CSA A3002 – Masonry and Mortar Cement

Material Contents

Table S1 presents the material content by input material for Riverside cement products.

Table S1: Material Content for Riverside Cements, kg per metric ton finished cement

Material Inputs	Riverside Type I/II/V	Riverside Type III	Riverside Plastic
Clinker	907	897	764
Gypsum	55.4	80.4	50.5
Limestone	31	22	169
Inorganic process addition	6.5	0	16.7
Grinding aids, wet	0.494	0.821	0.334
Total	**1,000**	**1,000**	**1,000**

Life Cycle Assessment

The life cycle assessment results are calculated on the basis of one metric ton of cement and shown in Table S2; the results are also calculated on the basis of one short ton (2,000 lbs) and shown in Table S3.

Table S2: LCA Results (A1-A3) – 1 metric ton Riverside cements

Environmental Indicator	Unit	Riverside Type I/II/V	Riverside Type III	Riverside Plastic
TRACI 2.1 impact categories				
Global warming potential (GWP)	kg CO_2 eq.	969	962	823
Acidification potential	kg SO_2 eq.	1.70	1.71	1.48
Eutrophication potential	kg N eq.	0.0874	0.0910	0.0742
Smog creation potential	kg O_3 eq.	38.6	38.6	32.8
Ozone depletion potential	kg CFC-11 eq.	9.82E-07	1.27E-06	7.70E-07
Total primary energy consumption				
Non-renewable fossil	MJ (HHV)	5,502	5,490	4,736
Non-renewable nuclear	MJ (HHV)	142	143	130
Renewable (solar, wind, hydroelectric, and geothermal)	MJ (HHV)	143	143	133
Renewable (biomass)	MJ (HHV)	0.92	1.18	0.75
Material resources consumption				
Non-renewable material resources	kg	1,599	1,574	1,490
Renewable material resources	kg	0.0291	0.0390	0.0236
Net fresh water (inputs minus outputs)	l	666	820	576
Waste generated				
Non-hazardous waste generated	kg	2.75	2.73	2.47
Hazardous waste generated	kg	0.00709	0.00708	0.00632

Table S3: LCA Results (A1-A3) – 1 short ton Riverside cements

Environmental Indicator	Unit	Riverside Type I/II/V	Riverside Type III	Riverside Plastic
TRACI 2.1 impact categories				
Global warming potential (GWP)	kg CO_2 eq.	879	872	746
Acidification potential	kg SO_2 eq.	1.54	1.55	1.35
Eutrophication potential	kg N eq.	0.0793	0.0826	0.0673
Smog creation potential	kg O_3 eq.	35.0	35.0	29.7
Ozone depletion potential	kg CFC-11 eq.	8.91E-07	1.15E-06	6.99E-07
Total primary energy consumption				
Non-renewable fossil	MJ (HHV)	4991	4981	4296
Non-renewable nuclear	MJ (HHV)	129	130	118
Renewable (solar, wind, hydroelectric, and geothermal)	MJ (HHV)	129	129	121
Renewable (biomass)	MJ (HHV)	1	1	1
Material resources consumption				
Non-renewable material resources	kg	1,451	1,428	1,351
Renewable material resources	kg	0.0264	0.0354	0.0215
Net fresh water (inputs minus outputs)	l	604	744	522
Waste generated				
Non-hazardous waste generated	kg	2.50	2.48	2.24
Hazardous waste generated	kg	0.00643	0.00642	0.00574

Additional Information

Table S4 below reports two additional environmental indicators.

Table S4: Additional Cradle-to-gate Environmental Indicator Results

Material Inputs	Unit	Riverside Type I/II/V	Riverside Type III	Riverside Plastic
Recovered materials	kg	17.2	10.6	25.7
Respiratory effects	kg PM2.5 eq.	0.92	1.08	0.83