



Davenport, IA Cement Plant

An Environmental Product Declaration





An Environmental Product Declaration

In accordance with ISO 14025 and 21930

About this EPD

This is a cradle-to-gate environmental product declaration (EPD) for blended Type IL(10) and IS(20) cements as produced by Continental Cement Company at its Davenport, IA plant. The results of the underlying LCA are computed with the North American (N.A.) version of the Global Cement and Concrete Association (GCCA) Industry EPD Tool for cement and concrete [1]. This tool and the underlying LCA model and database [2] have been previously verified to conform to the prevailing sub-product category rule (PCR) [3], ISO 21930:2017 (the core PCR) [4] as well as ISO 14020:2000 [5] and ISO 14040/44:2006 LCA standards [7], [8].

This EPD is certified by ASTM to conform to the Sub-Product Category Rule (PCR) referenced above, as well as to the requirements of ISO 14020, ISO 14025 [6], ISO 21930 and ASTM International's General Program Instructions [9]. This EPD is intended for business-to-business audiences.

General Summary

EPD Commissioner and Owner

Continental Cement Company

16401 Swingley Ridge Road, Suite 610
Chesterfield, MO 63017

<https://www.continentalcement.com>

The Davenport Cement plant provided both LCI and meta-data for limestone extraction, clinker production and cement manufacture for reference year 2020. The owner of the declaration is liable for the underlying information and evidence.

Product Group and Name

Cement, UN CPC 3744.

Product Definition

Blended cement is 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).

- Type IL (ASTM C595 [13]) — is a portland-limestone cement and is a hydraulic cement in which the limestone content is more than 5 % but less than or equal to 15 % by mass of the blended cement
- Type IS (ASTM C595 [13]) – is a Portland slag cement with blends containing up to 70% slag cement.

Product Category Rules (PCR)

NSF International, Product Category Rules for Preparing an Environmental Product Declaration for Portland, Blended Hydraulic, Masonry, Mortar, and Plastic (Stucco) Cements, V3.2, September 2021 [3].

Date of Issue & Validity Period

August 23, 2022 – 5 years

Declared Unit

1 metric ton of cement

EPD and Project Report Information





An Environmental Product Declaration

In accordance with ISO 14025 and 21930

Program Operator	ASTM International
Declaration Number	EPD 357
Declaration Type	Cradle-to-gate (modules A1 to A3). Facility and product-specific.
Applicable Countries	United States
Product Applicability	Portland cement is the basic ingredient of concrete. Concrete, one of the most widely used construction materials in the world, is formed when Portland cement creates a paste with water that binds with sand and rock to harden.

Content of the Declaration This declaration follows Section 9; Content of an EPD, NSF International, Product Category Rules for Preparing an Environmental Product Declaration for Portland, Blended Hydraulic, Masonry, Mortar, and Plastic (Stucco) Cements, V3.2, September 2021 [3].

This EPD was independently verified by ASTM in accordance with ISO 14025 and the reference PCR:

Tim Brooke
 ASTM International
 100 Barr Harbor Drive
 PO Box C700
 West Conshohocken
 PA 19428-2959, USA
cert@astm.org

Thomas P. Gloria, Ph. D.
 Industrial Ecology Consultants
 35 Bracebridge Rd.
 Newton, MA

Internal External

Notes The EPD results reported herein are computed using the N.A. GCCA Industry EPD tool for Cement and Concrete (<https://concrete-epd-tool.org>).

EPD Prepared by: Athena Sustainable Materials Institute
 280 Albert Street, Suite 404
 Ottawa, Ontario, Canada K1P 5G8
info@athenasmi.org
www.athenasmi.org



PCR Information

Program Operator	NSF International
Reference PCR	Product Category Rules for Preparing an Environmental Product Declaration for Portland, Blended Hydraulic, Masonry, Mortar, and Plastic (Stucco) Cements, V3.2, September 2021 [3].
PCR review was conducted by:	Thomas P. Gloria, PhD (Chair), Industrial Ecology Consultants, Mr. Jack Geibig, EcoForm Mr. Bill Stough, Sustainable Research Group

Continental Cement Company & Production Facility





An Environmental Product Declaration

In accordance with ISO 14025 and 21930

Continental Cement Company, headquartered in Chesterfield Missouri, is one of the leading cement manufacturing companies in the mid-west US. Continental Cement Company began making cement in 1903 and are the proud producers of high-quality cement that has been used in many iconic construction projects, like the Empire State Building and the Panama Canal. Continental Cement Company is a wholly-owned subsidiary of Summit Materials, Inc.

Facility Name: Davenport Cement Plant
301 E. Front St
Buffalo, Iowa 52728

Product Description

This EPD reports environmental transparency information for two cement types produced by Continental Cement Company at its Davenport, IA plant. Cements are hydraulic binders and are manufactured by grinding cement clinker and other main or minor constituents into a finely ground, usually grey colored mineral powder. When mixed with water, cement acts as a glue to bind together the sand, gravel or crushed stone to form concrete, one of the most durable, resilient and widely used construction materials in the world. The Table below sets out each cement type constituents and applicable standards. Cements are sold in bulk.

Products and Standards

Inputs	Blended Type IL (10) ASTM C595	Blended Type IS (20) ASTM C595
Clinker	83%	70%
Gypsum	5%	5%
Limestone	10%	0%
Slag Cement	0%	21%
Grinding/processing aids	2%	4%
Total	100%	100%

Applicable Standards:

ASTM C595 / C595M –Standard Specification for Blended Hydraulic Cement

Declared Unit

The declared unit is one metric ton of cement.

System Boundary

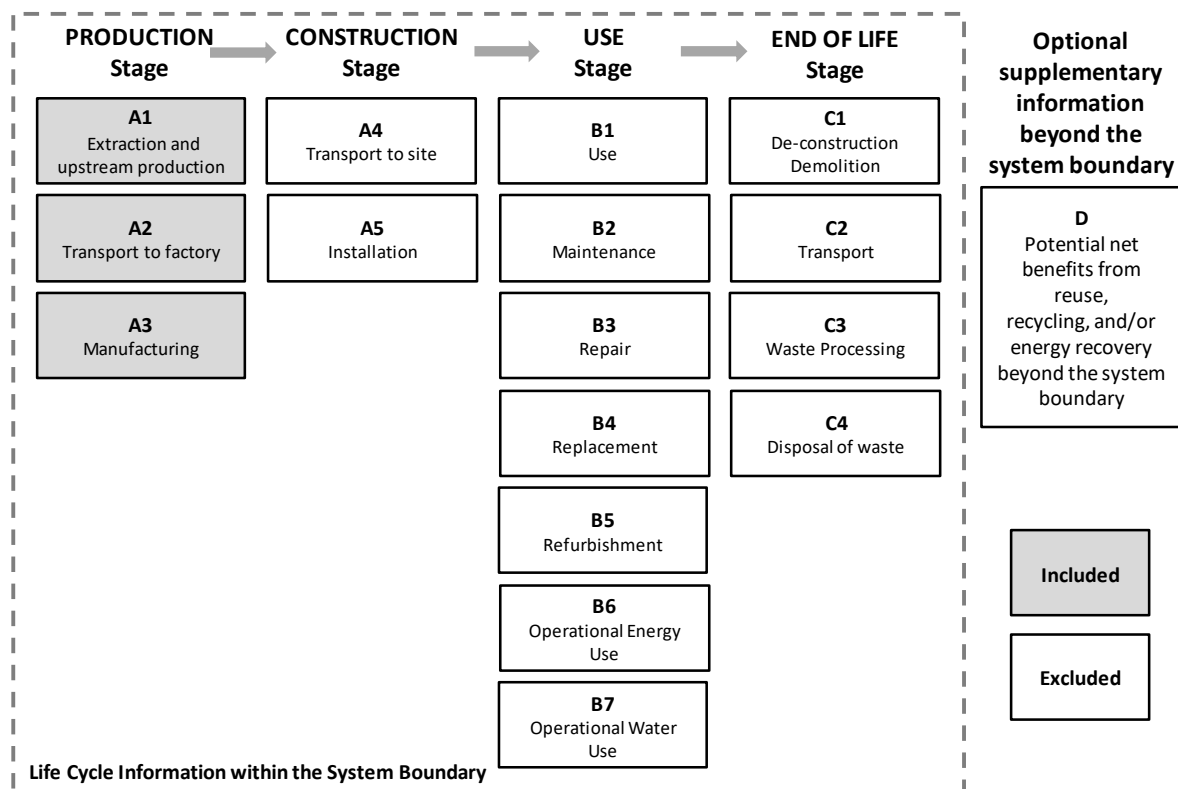
This is a cradle-to-gate EPD covering the production stage (A1-A3) as depicted in the figure below. The production stage includes extraction of raw materials (cradle) through the manufacture of cements ready for shipment (gate). The Davenport cement plant sources its limestone supply from an adjacent quarry and ships its cements in bulk.





An Environmental Product Declaration

In accordance with ISO 14025 and 21930



Items excluded from the system boundary include:

- Production, manufacture, and construction of manufacturing capital goods and infrastructure
- Production and manufacture of production equipment, delivery vehicles, and laboratory equipment
- Personnel-related activities (travel, furniture, and office supplies)
- Energy and water use related to company management and sales activities that may be located either within the factory site or at another location

Cut-off Criteria

The cut-off criteria as per NSF PCR, Section 7.1.8 [3] and ISO 21930, 7.1.8 [4] were followed. Per ISO 21930, 7.1.8, all input/output data required were collected and included in the LCI modelling. No substances with hazardous and toxic properties that pose a concern for human health and/or the environment were identified in the framework of this EPD

Data Collection

Gate-to-gate input/output flow data were collected for the following processes for the reference year 2020:

- Limestone quarry operations, clinker production and cement manufacture.

Allocation Rules

Allocation of inventory flows and subsequently environmental impact is relevant when assets are shared between product systems. The allocation method prescribed by the PCR [3] is applied in the underlying LCA model. The sub-category PCR recognizes fly ash, furnace bottom ash, bypass dust, mill scale, polluted soils, spent catalyst,





An Environmental Product Declaration

In accordance with ISO 14025 and 21930

aluminum oxide waste, silica fume, granulated blast furnace slag, iron rich waste, cement kiln dust (CKD), flue gas desulfurization (FGD) gypsum, calcium fluoride rich waste and postconsumer gypsum as recovered materials and thus, the environmental impacts allocated to these materials are limited to the treatment and transportation required to use as a cement material input. Further, used tires, plastics, solvents, used oil and oily waste, coal/carbon waste, roofing asphalt, household refuse-derived waste, non-hazardous liquid waste, industrial sludge, and agricultural waste are considered non-renewable and/or renewable secondary fuels. Only the materials, water, energy, emissions, and other elemental flows associated with reprocessing, handling, sorting and transportation from the point of the generating industrial process to their use in the production process are considered. All emissions from combustion at the point of use are considered. For co-products, no credit is considered, and no allocation is applied. See the LCA model and LCA database reports of the N.A. version of GCCA's Industry Tool for EPDs of cement and concrete for more information [1 & 2].

Data Quality Requirements and Assessment

Data Quality Requirements	Description
Technology Coverage	<p>Data represents the prevailing technology in use at the Davenport facility. Whenever available, for all upstream and core material and processes, North American typical or average industry LCI datasets were utilized.</p> <p>The Davenport plant utilizes <i>a dry kiln with preheater and precalciner technology. Technological representativeness is characterized as "high".</i></p>
Geographic Coverage	<p>The geographic region considered is U.S.</p> <p><i>Geographical representativeness is characterized as "high".</i></p>
Time Coverage	<p>Activity (primary) data are representative of 2020 calendar year (12 months).</p> <ul style="list-style-type: none"> - Davenport limestone extraction, - Davenport clinker production, - Davenport cement manufacturing, - In-bound/out-bound transportation data - primary data collected for quarry site and cement manufacturing plant. <p><i>Electricity resource mix is modelled based on NERC MRO region as provided in the GCCA Tool and with the following make-up: 53% coal, 9% natural gas, 10% nuclear, 6% hydro, and renewables (biomass, wind and solar) 21%.</i></p> <p><i>Temporal representativeness is characterized as "high".</i></p>
Completeness	<p>All relevant, specific processes, including inputs (raw materials, energy and ancillary materials) and outputs (emissions and production volume) were considered and modeled in the GCCA Tool to complete production profile for Davenport cement products. The Davenport cement plant operates a continuous emissions monitoring system and reports emissions to the US EPA. These data for 2020 were drawn on in the completion of this EPD. The completeness of the foreground process chain in terms of process steps was rigorously assessed.</p>





An Environmental Product Declaration

In accordance with ISO 14025 and 21930

Consistency	To ensure consistency, cross checks of the energy demand and the calculated raw meal to clinker ratio against ranges reported in the WBCSD Cement Sustainability Initiative, Cement CO2 and Energy Protocol, v3.1 December, 2013 were conducted [15]. The LCA team conducted mass and energy balances at the facility level and selected process levels to maintain a high level of consistency
Reproducibility	External reproducibility is not possible as the source LCI data and subsequent LCI background reports are confidential.
Transparency	Activity datasets are disclosed in the project LCI compilation, and the background reports generated by the GCCA Tool.
Uncertainty	A <i>sensitivity check</i> was conducted relative to the PCA industry average [16]. The variation across significant inputs were found to be well within the expected range and hence, there is high degree of confidence in the results.

Life Cycle Impact Assessment Results: Davenport Plant

This section summarizes the production stage life cycle impact assessment (LCIA) results including resource use and waste generated metrics based on the cradle-to-gate life cycle inventory inputs and outputs analysis. The results are calculated based on 1 metric ton of each cement type as produced at the Davenport plant.

It should be noted that LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks [4], [8]. Further, many LCA impact categories and inventory items are still emerging or under development and can have high levels of uncertainty that preclude international acceptance pending further development. Use caution when interpreting results for these categories – identified with an “*” [3].

Only EPDs prepared from cradle-to-grave life-cycle results and based on the same function, quantified by the same functional unit, and taking account of replacement based on the product reference service life (RSL) relative to an assumed building service life, can be used to assist purchasers and users in making informed comparisons between products [3]. Environmental declarations from different programs may not be comparable [6]. EPDs are comparable only if they comply with ISO 21930, use the same, sub-category PCR where applicable, include all relevant information modules and are based on equivalent scenarios with respect to the context of construction works [3&4].

Production stage EPD Results – per metric ton





An Environmental Product Declaration

In accordance with ISO 14025 and 21930

Impact category and inventory indicators	Unit	Blended Type IL (10) ASTM C595	Blended Type IS (20) ASTM C595
Global warming potential, GWP 100, AR5	kg CO2 eq	928	824
Ozone depletion potential, ODP	kg CFC-11 eq	1.25E-05	1.46E-05
Smog formation potential, SFP	kg O3 eq	49	42
Acidification potential, AP	kg SO2 eq	2.7	2.4
Eutrophication potential, EP	kg N eq	1.5	1.4
Abiotic depletion potential for non-fossil mineral resources, ADP elements*	kg Sb eq	1.69E-04	1.98E-04
Abiotic depletion potential for fossil resources, ADP fossil*	MJ LHV	218	238
Renewable primary resources used as an energy carrier (fuel), RPRE*	MJ LHV	178	174
Renewable primary resources with energy content used as material, RPRM*	MJ LHV	0	0
Non-renewable primary resources used as an energy carrier (fuel), NRPRE*	MJ LHV	3452	3235
Non-renewable primary resources with energy content used as material, NRPRM*	MJ LHV	0	0
Secondary materials, SM*	kg	60	328
Renewable secondary fuels, RSF *	MJ LHV	112	95
Non-renewable secondary fuels, NRSF *	MJ LHV	697	592
Recovered energy, RE*	MJ LHV	0	0
Consumption of freshwater, FW*	m3	0.7	0.7
Hazardous waste disposed, HWD*	kg	0	0
Non-hazardous waste disposed, NHWD *	kg	1.6	1.4
High-level radioactive waste, conditioned, to final repository, HLRW*	kg	x ¹⁾	x ¹⁾
Intermediate- and low-level radioactive waste, conditioned, to final repository, ILLRW*	kg	x ¹⁾	x ¹⁾





An Environmental Product Declaration

In accordance with ISO 14025 and 21930

Components for re-use, CRU*	kg	0	0
Materials for recycling, MFR*	kg	587	498
Materials for energy recovery, MER*	kg	0	0
Recovered energy exported from the product system, EE*	MJ LHV	0	0
Global warming potential - biogenic, GWPbio*	kg CO ₂ eq	0.7	0.6
Emissions from calcination*	kg CO ₂ eq	433	368
Emissions from combustion of waste from renewable sources*	kg CO ₂ eq	0.1	<0.1
Emissions from combustion of waste from non-renewable sources*	kg CO ₂ eq	64	54

Table Notes:

x¹⁾ – The GCCA EPD Tool does not support these indicators.

* Use caution when interpreting results for these categories

LCA Interpretation

The Manufacturing module (A3) drives most of the potential environmental impacts. Manufacturing impacts are primarily driven by energy use (electricity and thermal fuels) during the pyroprocessing of limestone in the production of clinker. Clinker content in cement similarly defines the relative environmental profile of the final cement product. Raw material extraction (A1) is the second largest contributor to the Production stage EPD results, followed by transportation (A2).

Additional Environmental Information

Environmental Protection and Equipment

Dewey Portland Cement built and opened the plant in Buffalo, Iowa in 1927. The plant operated 3 long wet kilns. In 1962, the plant was purchased by Martin-Marietta. In 1980, the plant was rebuilt into a single line preheater/pre-calciner kiln operation. Cementia purchased the plant in 1983 and then sold to Lafarge in 1991. Modifications were made to reduce emissions and increase throughput in 2004 and 2005. In 2015 the plant was purchased by Continental Cement Company, a subsidiary of Summit Materials.

Air pollution control equipment in use at the Davenport plant includes high temperature baghouse, bin vents, cartridge filters, selective non-catalytic reduction (SNCR), and activated carbon injection. Raw mill baghouse dust (CKD) is captured and used as a processing aid in the finish mill.

References





An Environmental Product Declaration

In accordance with ISO 14025 and 21930

1. Global Cement and Concrete Association (GCCA) and Portland Cement Association (PCA), *GCCA Industry EPD Tool for Cement and Concrete (V3.0), Users Manual, North American version*, Prepared by Quantis, April 2021. <https://demo.gcca.quantis.solutions/us>
2. Global Cement and Concrete Association (GCCA) 2021. LCA Database, North American version, Prepared by Quantis, April 2021
3. NSF International, Product Category Rule Environmental Product Declarations, PCR for Portland, Blended, Masonry, Mortar, and Plastic (Stucco) Cements, V3.2, September 2021.
4. ISO 21930:2017 Sustainability in buildings and civil engineering works - Core rules for environmental product declarations of construction products and services.
5. ISO 14020:2000 Environmental labels and declarations — General principles
6. ISO 14025:2006 Environmental labeling and declarations - Type III environmental declarations - Principles and procedures.
7. ISO 14040:2006/Amd1:2020 Environmental management - Life cycle assessment - Principles and framework.
8. ISO 14044:2006/Amd1:2017/Amd2:2020 Environmental management - Life cycle assessment - Requirements and guidelines.
9. ASTM General Program Instructions. V.8.0, April 29, 2020.
10. NSF International, Product Category Rule Environmental Product Declarations, PCR for Concrete, V2.1, August 2021.
11. ASTM C150 / C150M – 20 Standard Specification for Portland Cement.
12. ASTM C91 - Standard Specification for Mortar for Unit Masonry
13. ASTM C595 / C595M - 21 Standard Specification for Blended Hydraulic Cements
14. AASHTO M 85-21 Standard Specification for Portland Cement (ASTM Designation: C150/C150M-21) <https://www.cement-co2-protocol.org/en/>
15. WBCSD CSI 2013: CO₂ and Energy Protocol Version 3.1 of 9 December 2013. <https://www.cement-co2-protocol.org/en/>
16. Portland Cement Association Environmental Product Declaration – Portland Cement, ASTM International, March 12, 2021. https://www.astm.org/CERTIFICATION/DOCS/634.EPD_for_Portland_Athena_Final_revised_04082021.pdf

