Pennsuco Cement Plant

(Medley, FL)

An Environmental Product Declaration

About this EPD

This is a Type III environmental product declaration (EPD) for Type I/II, IL stucco, and masonry cements as produced by Titan Florida Cement and Aggregates (a division of Titan America) at its Pennsuco plant located in Medley, FL. The results of the underlying LCA are computed using 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 [3], 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	**Titan Florida LLC** 455 Fairway Drive Deerfield Beach, FL 33441 https://www.titanamerica.com The owner of the declaration is liable for the underlying information and evidence.
Product Group and Name	*Cement, UN CPC 3744.*
Product Definition	***Portland cement*** is defined as a hydraulic cement produced by pulverizing clinker, consisting essentially of crystalline hydraulic calcium silicates, and usually containing one or more of the following: calcium sulfate, up to 5% limestone, and processing additions (NSF PCR 2021 [10], ASTM C150 [11]. Portland Cement *Type I*—For use when the special properties specified for any other type are not required. Portland Cement *Type II*—For general use, more especially when moderate sulfate resistance is desired. Portland Cement Type III—For use when high early strength is desired. Some cements are designated with a combined type classification, such as Type I/II, indicating that the cement meets the requirements of the indicated types and is being offered as suitable for use when either type is desired. ***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) — 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.

	Masonry cement is hydraulic cement manufactured for use in mortars for masonry construction or in plasters, or both, which contains a plasticizing material and, possibly, other performance-enhancing addition(s). Mortar cements are produced in Type N, Type S, and Type M classifications for use in preparation of ASTM Specification C91 ***Plastic (stucco) cement*** is hydraulic cement manufactured for use in plasters. Plastic (stucco) cements are produced in Type S and Type M classifications for use in preparation of ASTM Specification C1328.
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	July 20, 2023 – 5 years
Declared Unit	1 metric ton of cement

EPD and Project Report Information

Program Operator	ASTM International	
Declaration Number	EPD 545	
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: Internal External X	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
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

Titan Cement & Production Facility

Titan America is a leading environmentally and socially-progressive heavy building materials company located in the eastern United States and headquartered in Norfolk, Virginia. In operation since 1902, Titan remains a family-led business with a values-oriented, people-focused culture.

The company operates two cement plants in Roanoke, Virginia, and Medley, Florida. It also operates a number of cement terminals serving the US east coast. This EPD covers to 4 cement types produced at Titan's Medley, Florida plant.

The plant is located at:

Titan Florida Cement and Aggregates, Pennsuco Cement Plant, 11000 Northwest 121 Way, Medley Florida 33178

Product Description

This EPD reports environmental transparency information for 4 cements produced by Titan Florida Cement and Aggregates at its Medley, FL plant. Cements are hydraulic binders and are manufactured by grinding cement clinker and other 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.

Products and Standards

The Titan Pennsuco Type I/II, Type IL, Masonry, and Stucco cements comply with the following standards as applicable:

ASTM C150 / C150M –Standard Specification for Portland Cement
ASTM C595 / C595M –Standard Specification for Blended Hydraulic Cement
ASTM C91 / C91M Standard Specification for Masonry Cement
ASTM C1329 / C1328M Standard Specification for Plastic (Stucco) Cement

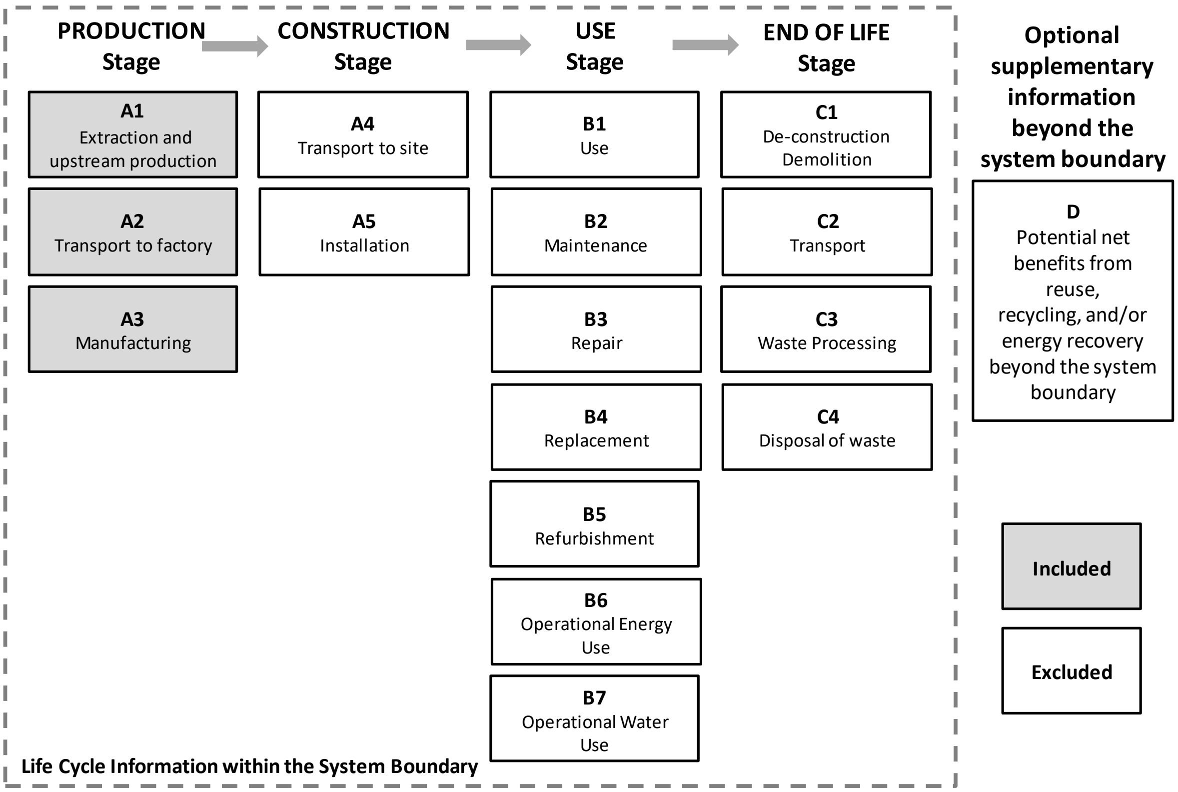
AASHTO M 85 Standard Specification for Portland Cement (ASTM Designation: C150 / C150M)

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 Pennsuco (Medley) Plant sources its limestone supply from an adjacent, on-site quarry and ships its cement in bulk.



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 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 2021:

- 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, 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 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	Data represents the prevailing technology in use at the Kamari facility. Whenever available, for all upstream and core material and processes, both International and North American typical or average industry LCI datasets were utilized. The Pennsuco plant utilizes *a preheater and precalcinator kiln technology*. *Technological representativeness is characterized as "high".*
Geographic Coverage	The geographic region considered is United States. *Geographical representativeness is characterized as "high".*
Time Coverage	Activity (primary) data are representative of 2021 calendar year (12 months). - Pennsuco limestone extraction - Rennsuco clinker production, - Pennsuco cement manufacturing, - In-bound/out-bound transportation data - primary data collected for quarry site and cement manufacturing plant. *Temporal representativeness is characterized as "high".*

Completeness	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 the production profile for Titan Florida Cement and Aggregate's cement products. Primary air emissions continuously monitored system. These data for 2021 were drawn on in the completion of this EPD. The completeness of the foreground process chain in terms of process steps is rigorously assessed.
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].
Reproducibility	External reproducibility is not possible as the source LCI data and subsequent LCA 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 *sensitivity check* 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

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 Roanoke 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

Impact category and inventory indicators	Unit	**Type I/II** ASTM C150	**Type IL** ASTM C595	**Masonry M** ASTM C91	**Stucco S** ASTM C1328
Global warming potential, GWP 100, AR5	kg CO2 eq	796	738	532	530
Ozone depletion potential, ODP	kg CFC-11 eq	1.86E-05	1.84E-05	1.49E-05	1.49E-05
Smog formation potential, SFP	kg O3 eq	36.4	34.0	25.3	25.2

Acidification potential, AP	kg SO2 eq	1.62	1.55	1.17	1.17
Eutrophication potential, EP	kg N eq	0.6	0.6	0.4	0.4
Abiotic depletion potential for non-fossil mineral resources, ADP elements*	kg Sb eq	1.35E-04	1.72E-04	1.16E-04	1.17E-04
Abiotic depletion potential for fossil resources, ADP fossil*	MJ LHV	264	288	219	219
Renewable primary resources used as an energy carrier (fuel), RPRE*	MJ LHV	52	58	40	540
Renewable primary resources with energy content used as material, RPRM*	MJ LHV	0	0	0	6
Non-renewable primary resources used as an energy carrier (fuel), NRPRE*	MJ LHV	2374	2497	1786	1783
Non-renewable primary resources with energy content used as material, NRPRM*	MJ LHV	0	0	0	0
Secondary materials, SM*	kg	43.1	39.7	30.1	30.0
Renewable secondary fuels, RSF *	MJ LHV	92	83	60	59
Non-renewable secondary fuels, NRSF *	MJ LHV	263	239	171	170
Recovered energy, RE*	MJ LHV	0	0	0	0
Consumption of freshwater, FW*	m3	0.6	0.7	0.5	0.5
Hazardous waste disposed, HWD*	kg	0.03	0.03	0.02	0.02
Non-hazardous waste disposed, NHWD *	kg	0.26	0.24	0.17	0.17
High-level radioactive waste, conditioned, to final repository, HLRW*	kg	**x[1])**	**x[1])**	**x[1])**	**x[1])**
Intermediate- and low-level radioactive waste, conditioned, to final repository, ILLRW*	kg	**x[1])**	**x[1])**	**x[1])**	**x[1])**
Components for re-use, CRU*	kg	0	0	0	0
Materials for recycling, MFR*	kg	0.1	0.1	0.1	0.1
Materials for energy recovery, MER*	kg	0	0	0	0
Recovered energy exported from the product system, EE*	MJ LHV	0	0	0	0
Global warming potential - biogenic, GWPbio*	kg CO_2 eq	0.75	0.73	0.60	0.6
Emissions from calcination*	kg CO_2 eq	485	441	316	314

Emissions from combustion of waste from renewable sources*	kg CO_2 eq	5.5E-02	5.0E-02	3.5E-02	3.6E-02
Emissions from combustion of waste from non-renewable sources*	kg CO_2 eq	30.3	27.6	19.7	19.6

Table Notes:
x[1)] – 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).

References

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 / C91M – 18 Standard Specification for Masonry Cement
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: CO_2 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