DRAKE

UNACEM North America Natural Pozzolan

Manufactured at Drake Cement Plant

An Environmental Product Declaration

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An Environmental Product Declaration

In accordance with ISO 14025 and 21930

About this EPD

This is a Type III environmental product declaration (EPD) for natural pozzolan produced by UNACEM North America at its Drake cement plant located in Paulden, AZ. The results of the underlying LCA are computed using SimaPro v10.2.0.1 [1]. The underlying LCA has been verified to conform to Smart EPD Part A PCR for Building and Construction Products and Services, v1.2 [2], Smart EPD Part B PCR for Supplementary Cementitious Materials, v1.0 [3], ISO 21930:2017 [4] as well as ISO 14020:2000 [5] and ISO 14040/44:2006 LCA standards [6], [7].

This EPD is certified by ASTM to conform to the Part A & B Product Category Rules (PCRs) referenced above [2], [3], as well as to the requirements of ISO 14020, ISO 14025 [8], 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	**UNACEM North America** 21803 N Scottsdale Rd, Suite 220 Scottsdale, AZ. 85255 https://drakeus.com/ Drake company personnel have provided LCI and meta data for natural pozzolan extraction and manufacture for the 2024 reference year in support of this EPD. *The owner of the declaration is responsible for the underlying information and evidence.*
Product Group and Name	*Natural Pozzolan.*
Product Definition	Natural pozzolan is a siliceous or siliceous-aluminous material that reacts with calcium hydroxide in the presence of water to form cementitious compounds. It is used as a supplementary cementitious material in concrete, enhancing durability, reducing permeability, and mitigating alkali-silica reaction. Natural pozzolans can partially replace portland cement. Common sources include volcanic ash, pumice, and diatomaceous earth.
Product Category Rules (PCR)	Smart EPD Part A Product Category Rules for Building and Construction Products and Services, version 1.2. March 14, 2025. [2] Smart EPD Part B Product Category Rules for Supplementary Cementitious Materials, version 1.0. May 7, 2024. [3]
Date of Issue & Validity Period	August 1st, 2025 – 5 years
Declared Unit	1 metric ton of natural pozzolan

EPD and Project Report Information

Program Operator	ASTM International
Declaration Number	EPD 1049
Declaration Type	Cradle-to-gate (modules A1 to A3). Facility and product specific.
Applicable Countries	North America
Product Applicability	Natural Pozzolan is used as a supplementary cementitious material in concrete, enhancing durability, reducing permeability, and mitigating alkali-silica reaction.
Content of the Declaration	This declaration follows Section 9; EPD Content, Smart EPD, Product Category Rules for Supplementary Cementitious Materials, Standard 1000-002, Version 1.0, May 7, 2024 [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
EPD Prepared by: Athena Sustainable Materials Institute	Athena Sustainable Materials Institute 280 Albert Street, Suite 404 Ottawa, Ontario, Canada K1P 5G8 info@athenasmi.org www.athenasmi.org

PCR Information

Program Operator	Smart EPD
Reference PCR	Part B Product Category Rules for Supplementary Cementitious Materials, Standard 1000-002, Version 1.0, May 7, 2024 [3].
PCR review was conducted by:	Mr. Jack Geibig, EcoForm Consulting Larry Sutter, Sutter Engineering Craig Heidrich, Ash Development Association of Australia

Drake Plant Production Facility

Facility Name: **Drake Cement Plant** 5001 E Drake Rd. Paulden, AZ. 86334.

Product Description

This EPD reports environmental transparency information for natural pozzolan produced by UNACEM North America at its Drake plant in Paulden, AZ. The table below outlines the constituents of natural pozzolan and its applicable standards.

Products and Standards

Inputs	Type I/II/V ASTM C150
Natural Pozzolan	100%
Total	100%

Applicable Standards:

ASTM C618-22 Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete [10]

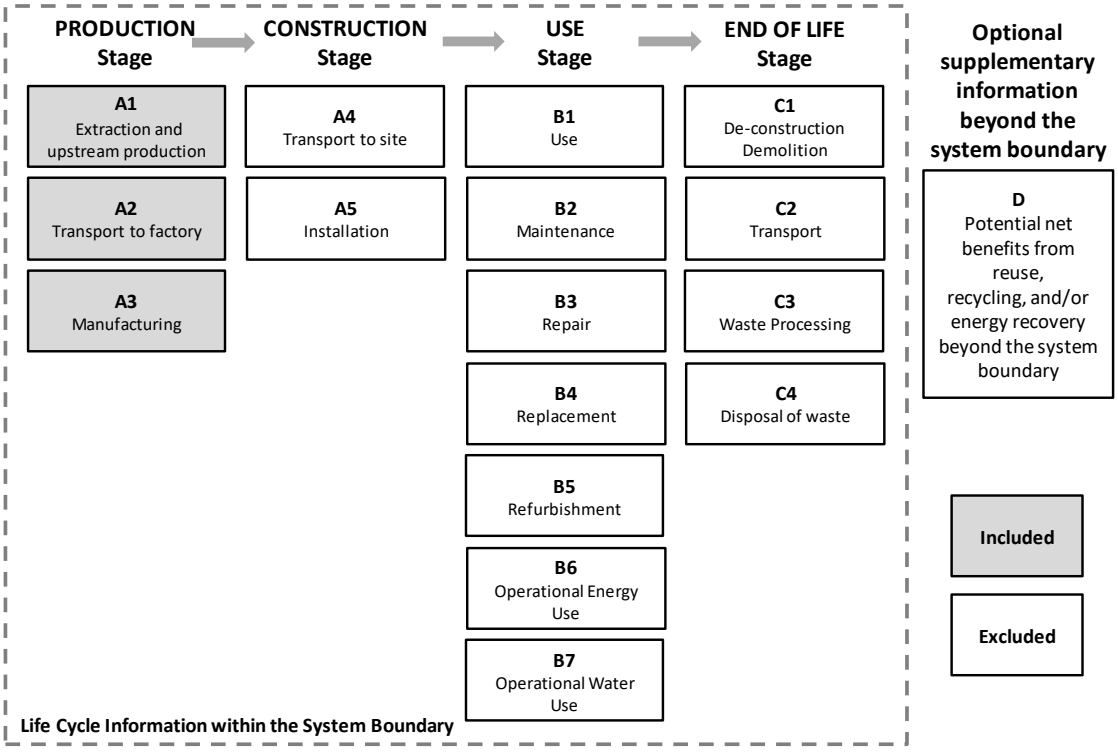
AASHTO M 295-21 Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete [11]

Declared Unit

The declared unit is one metric ton of natural pozzolan.

System Boundary

This EPD 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 natural pozzolan ready for shipment (gate). The Drake cement plant extracts its raw natural pozzolan from a nearby quarry. The plant's natural pozzolan is sold 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 Smart EPD Part B 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 modeling. 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 was collected for the following processes for the reference year 2024:

- Natural pozzolan quarry operations, transport, and manufacture.

Allocation Rules

Allocation of inventory flows and subsequent 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 secondary materials, such as coal ash, recycled glass, waste CO_2 gas, and silica fume 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.

Data Quality Requirements and Assessment

Data Quality Requirements	Description
Technology Coverage	LCI data represents the prevailing technology in use at the Drake cement plant and natural pozzolan quarry. *Technological representativeness is characterized as "high".*
Geographic Coverage	The geographic region considered is the U.S and Canada. *Geographical representativeness is characterized as "high".*
Time Coverage	Activity (primary) data are representative of 2024 calendar year (12 months) covering - Output of finished product, - Input of all materials and energy, - Inbound and outbound transportation data *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 to complete production profile for Drake's natural pozzolan production. The completeness of the foreground process chain in terms of process steps has been rigorously assessed.
Consistency	Crosschecks concerning the plausibility of mass and energy flows were continuously conducted. The LCA team conducted mass balance at the facility and product level to maintain a high level of consistency.

Reproducibility	External reproducibility is not possible as the background report is confidential.
Transparency	Activity datasets are transparently disclosed in the project report, including all data sources. Background datasets have been selected from Ecoinvent v3.10, allocation, cut-off, EN-15804, April 2024.
Uncertainty	A *sensitivity check* was performed to assess the reliability of the reported LCA results and conclusions by determining how they are affected by value choices in the data or assumptions on calculation of LCIA and energy indicator results. The results of the sensitivity analysis are documented in the project report.

Background Datasets

As specified in Smart EPD's Part A PCR Section 9.3.6.2 [2], this section outlines the background datasets used to model UNACEM North America's natural pozzolan production in SimaPro v10.2.0.1.

Material/ Process	Database Name and Version	Dataset Name	Geography	Year Dataset Represents
Motor Oils and Greases	Ecoinvent 3.10, allocation, cut-off, EN15804. April 2024.	*Lubricating oil {RoW}| lubricating oil production | EN15804, U*	Global	Created: 2007 Last Updated: 2017
Antifreeze	Ecoinvent 3.10, allocation, cut-off, EN15804. April 2024.	**50% Ethylene Glycol** *Ethylene glycol {RoW}| market for ethylene glycol | EN15804, U* **50% Deionized Water** *Water, deionized {RoW}| market for water, deionized | EN15804, U*	Global	**Deionized Water** Created: 2017 Last Updated: 2022 **Ethylene Glycol** Created: 2011 Last Updated: 2011
Diesel, low sulfur	Ecoinvent 3.10, allocation, cut-off, EN15804. April 2024.	*Diesel, burned in building machine {GLO}| diesel, burned in building machine | EN15804, U*	Global	Created: 2010 Last Updated: 2024
Gasoline, low sulfur	Ecoinvent 3.10, allocation, cut-off, EN15804. April 2024.	*Petrol, unleaded, burned in machinery {GLO}| market for petrol, unleaded, burned in machinery | EN15804, U*	Global	Created: 2016 Last Updated: 2016
Truck – Short Haul	Ecoinvent 3.10, allocation, cut-off, EN15804. April 2024.	*Transport, freight, lorry 16-32 metric ton, EURO6 {RoW}| transport, freight, lorry 16-32 metric ton, EURO6 | EN15804, U*	Global	Created: 2010 Last Updated: 2022
Electricity	Ecoinvent 3.10, allocation, cut-off, EN15804. April 2024. Modified with eGRID 2023 electricity generation data for the Arizona Public Service Company Balancing Authority	*Electricity, high voltage {US-WECC}| market for electricity, high voltage | EN15804, U_ eGRID2023*	Regional	Based on 2023 eGRID data at the Balancing Authority level

Life Cycle Impact Assessment Results: UNACEM North America Natural Pozzolan

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 one metric ton of natural pozzolan as produced at the Drake cement 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 asterisk "*".

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 21930:2017, 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: UNACEM North America Natural Pozzolan

Impact category and inventory indicators	Unit	A1 Extraction and Upstream Production	A2 Transportation	A3 Manufacturing	A1-A3 Total
Global Warming Potential, Total (GWP-tot)[1)]	kg CO_2 eq	3.29	12.1	34.0	49.45
Global Warming Potential, Fossil (GWP-fossil)[1)]	kg CO_2 eq	3.29	12.1	34.0	49.4
Global Warming Potential, biogenic (GWP-bio) [1)]	kg CO_2 eq	1.31E-04	5.20E-04	1.05E-02	1.12E-02
Global Warming Potential, Land Use and Land Use Change (GWP-luluc) [1)]	kg CO_2 eq	1.17E-04	3.95E-04	9.36E-04	1.45E-03
Acidification Potential (AP) [2)]	kg SO_2 eq	2.82E-02	1.42E-02	1.28E-01	1.71E-01
Eutrophication Potential, Freshwater (EP-f) [2)]	kg P eq	1.25E-05	1.07E-04	1.70E-02	1.71E-02
Eutrophication Potential, Marine (EP-m) [2)]	kg N eq	7.63E-03	1.89E-03	1.40E-02	2.35E-02
Smog Formation Potential (SFP) [2)]	kg O_3 eq	0.91	0.22	1.48	2.61
Ozone Depletion Potential (ODP) [2)]	kg CFC-11 eq	5.46E-08	1.84E-07	1.04E-07	3.43E-07
Abiotic Depletion Potential, fossil (ADPf)*[3)]	MJ, LHV	43.3	162	375	580
Renewable Primary Resource Used as Energy Carrier (RPR_E)* [4)]	MJ, LHV	0.100	0.26	10.7	11.1
Renewable Primary Resource with Energy content Used as Material (RPR_M)*[4)]	MJ, LHV	-	-	-	-
Total Use of Renewable Primary Resource with Energy Content (RPR_T)*	MJ, LHV	0.100	0.26	10.7	11.1
Non-Renewable Primary Resource Used as Energy Carrier ($NRPR_E$)* [4)]	MJ, LHV	43.5	162	376	582
Non-Renewable Primary Resource with Energy content Used as Material ($NRPR_M$)* [4)]	MJ, LHV	-	-	-	-
Total Non-Renewable Primary Resource with Energy Content ($NRPR_T$)*	MJ, LHV	43.5	162	376	582
Secondary Material (SM)* [4)]	kg	8.85E-05	1.19E-04	7.93E-04	1.00E-03
Renewable Secondary Fuels (RSF)* [4)]	MJ, LHV	1.79E-05	1.09E-05	6.15E-05	9.04E-05
Non-Renewable Secondary Fuels (NRSF)* [4)]	MJ, LHV	-	-	-	-
Recovered Energy (RE)*[9)]	MJ, LHV	1.20E-03	2.16E-03	1.19E-02	1.52E-02
Net Use of Freshwater Resources (FW)* [4)]	m³	1.40E-03	6.06E-03	4.08E-01	4.15E-01
Hazardous Waste Disposed (HWD)* [4)]	kg	4.97E-03	5.00E-02	2.23E+00	2.29E+00
Non-Hazardous Waste Disposed (NHWD)* [4)]	kg	0.16	1.26	185	187
High-level radioactive waste, conditioned, to final repository (HLRW)* [4) 5)]	m³	6.80E-07	1.93E-06	5.30E-06	7.92E-06
Intermediate and low-level radioactive waste, conditioned, to final repository (ILLRW)* [4) 6)]	m³	1.58E-06	3.78E-06	1.18E-05	1.71E-05
Components for Re-Use (CRU)* [4)]	kg	-	-	-	-
Materials for Recycling (MR)* [4)]	kg	1.14E-06	4.45E-06	3.24E-05	3.80E-05
Materials for Energy Recovery (MER)* [4)]	kg	6.86E-08	1.81E-07	2.07E-06	2.32E-06
Recovered Energy Exported from the Product System (EE)* [4)]	MJ, LHV	1.20E-03	2.16E-03	1.19E-02	1.52E-02

Table Notes:
* Use caution when interpreting results for these categories

[1] The Environmental Footprint (EF) Reference Package v3.1 has been used to calculate the GWP. This methodology uses the 100-year time horizon GWP factors from the IPCC 2021 Sixth Assessment Report (AR6), excluding carbon feedbacks.

[2] Calculated as per U.S EPA TRACI 2.2, v1.00, SimaPro v 10.2.0.1 (12).

[3] Calculated as per CML-IA Baseline v4.8, SimaPro v 10.2.0.1 (12). ADPf is also required in LEED V5 MR Credit: Building Product Disclosure and Optimization – Environmental Product Declarations.

[4] Calculated using EN 15804 +A2 LCIA & LCI Indicators v1.0 methodology, SimaPro v 10.2.0.1

[5] It should be noted that the foreground system (A3 manufacturing process) does not generate any HLRW. High-level radioactive waste, e.g., when generated by electricity production, consists mostly of spent fuel from reactors." (ISO 21930:2017, clause 7.2.14).

[6] It should be noted that the foreground system (A3 manufacturing process) does not generate any ILLRW. Low- and intermediate-level radioactive waste, e.g., when generated by electricity production, arises mainly from routine facility maintenance and operations (ISO 21930:2017, clause 7.2.14).

LCA Interpretation

The Manufacturing module (A3) drives most of the potential environmental impacts. Manufacturing impacts are primarily driven by electricity use for grinding of the natural pozzolan. The Transportation module (A2) is generally the second largest contributor to the total estimated environmental impact and is primarily driven by the transportation of natural pozzolan from the quarry to the manufacturing facility by truck.

Additional Environmental Information

Encapsulated beneficial use of SCMs may be an effective methodology for immobilizing elements of concern that may leach from an SCM when exposed to weathering conditions. Encapsulated beneficial use in concrete has been established as an acceptable means of immobilizing elements of concern that may leach from coal ash, for example. For SCMs other than coal ash, the effects of encapsulated beneficial use can be determined using standard procedures developed by the United States Environmental Protection Agency (U.S. EPA).

In general, the use of SCMs in concrete provides environmental benefits that are application-specific and thus outside the control of the SCM supplier. As a result, these benefits are outside the scope of this EPD. However, downstream users of SCMs are encouraged to capture these benefits within their own EPDs.

Examples of such environmental benefits include:

- **Cement optimization:** At proper dosages, SCMs allow concrete mixtures to use less portland cement while maintaining desired performance. Since portland cement typically has a larger carbon footprint than SCMs, this generally reduces the overall carbon footprint of the concrete.

- **Durability & longevity:** SCMs may improve long-term durability of many concrete mixes, especially those that are also using certain types of reactive aggregates and/or freeze-thaw concrete in freezing and thawing environments with heavy salt usage. By extending the service life of the concrete used for a project, the SCMs can reduce the carbon footprint associated with repeated repair and replacement of concrete infrastructure.

References

[1] PRé Sustainability. *SimaPro LCA Software. Version 10.2.0.1.* 2025.

[2] Smart EPD. Part A Product Category Rules for Building and Construction Products and Services. March 14, 2025. Standard 1000, version 1.2.

[3] Smart EPD. Part B Product Category Rules for Supplementary Cementitious Materials. May 7, 2024. Standard 1000-002, version 1.0.

[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 14040:2006/Amd2:2020 Environmental Management – Life Cycle Assessment – Requirements and guidelines.

[7] ISO 14044/Amd1:2017/Amd2:2020 Environmental Management – Life Cycle Assessment – Requirements and guidelines.

[8] ISO 14025:2006 Environmental labelling and declarations – Type III environmental declarations – Principles and Framework.

[9] ASTM Program Operator Rules. Version 8.0, Revised April 2020.

[10] ASTM C618-22 – Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.

[11] AASHTO M 295-21 – Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.