Environmental Product Declaration (EPD) for Cement

GENERAL INFORMATION

This cradle to gate Environmental Product Declaration covers five bulk cement products produced at the Nazareth Cement Plant. The Life Cycle Assessment (LCA) was prepared in conformity with ISO 21930, ISO 14025, ISO 14040, and ISO 14044. This EPD is intended for business-to-business (B-to-B) audiences.

Heidelberg Materials

Nazareth Cement Plant and Terminal
3938 Easton-Nazareth Highway
Nazareth, PA 18064

PROGRAM OPERATOR

National Ready Mixed Concrete Association
900 Spring Street
Silver Spring, MD 20910
https://www.nrmca.org/

NRMCAEPD: 20055

Environmental Impacts

Nazareth Plant: Product-Specific Type III EPD

Declared Cement Products (five):
Type IL; Type I; Type II; Type III; Masonry

Declared Unit: One metric tonne of cement

	Cement Products				
	Type IL	Type I	Type II	Type III	Masonry
Global Warming Potential (kg CO_2-eq)	**810**	**860**	**863**	**871**	**506**
Ozone Depletion Potential (kg CFC-11-eq)	2.55E-05	2.84E-05	2.68E-05	2.70E-05	1.73E-05
Eutrophication Potential (kg N-eq)	0.76	0.83	0.79	0.80	0.59
Acidification Potential (kg SO^2-eq)	2.15	2.32	2.28	2.30	1.36
Photochemical Ozone Creation Potential (kg O_3-eq)	27.63	30.17	29.22	29.55	16.90
Abiotic Depletion, nonfossil (kg Sb-eq)	1.26E-04	1.76E-04	1.29E-04	1.29E-04	8.70E-05
Abiotic Depletion, fossil (MJ)	673.06	730.20	711.81	718.20	414.90
Product Components:					
Clinker	86%	90%	92%	93%	52%
Limestone, Gypsum and Others	14%	10%	8%	7%	48%

Additional detail and impacts are reported on page 5 and 6

DATE OF ISSUE

January 13, 2022 (valid for 5 years until January 13, 2027)

ISO 21930:2017 Sustainability in Building Construction-Environmental Declaration of Building Products: serves as the core PCR NSF PCR for Portland, Blended, Masonry, Mortar, and Plastic (Stucco) Cements V3.2: serves as the sub-category PCR
Sub-category PCR review was conducted by Thomas P. Gloria, PhD. (t.gloria@industrial-ecology.com) • Industrial Ecology Consultants
Independent verification of the declaration, according to ISO 21930:2017 and ISO 14025:2006.: ☐ internal ☑ external
Third party verifier • Thomas P. Gloria, PhD. (t.gloria@industrial-ecology.com) • Industrial Ecology Consultants
For additional explanatory material Manufacture Representative: Jeff Hook (Jeff.Hook@HeidelbergMaterials.com) This LCA EPD was prepared by: Hannah Renaud (hannah.renaud@athenasmi.org) • Athena Sustainable Materials Institute
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.

LIFE CYCLE ASSESSMENT

PRODUCER

Heidelberg Materials a leading supplier of cementitious construction materials in North America. Through its legacy brands has been manufacturing cement in Pennsylvania since 1897. Beginning as a single-mill operation, we have become a pillar of the many communities around us and provide employment and economic benefit to small towns and cities. The first production of portland cement in North America was in the Lehigh Valley of Pennsylvania by Coplay Cement, which is now a part of Heidelberg Materials. The Nazareth plant location now operates to create cement products with the goal to mitigate our environmental impacts. Heidelberg Materials' commitment to sustainable construction includes actively working to create lower carbon cements through supplementary cementitious materials (SCMs) and alternative raw materials and fuels. Consistent with our vision of reducing greenhouse gas (GHG) emissions to have carbon neutral concrete by 2050, Heidelberg Materials has developed product and plant specific EPDs as baselines for its embodied carbon.

The health and well-being of our employees, communities, and the natural environment are vital to our success, so we work hard to give back through donations to several local organizations and foundations with a focus on conservation and community development.

PRODUCT

The cement products covered in this EPD meet UN CPC 3744 classification and the following standards:

Product Type	Applicable Standard	Standard Designation
Portland Limestone Cement	ASTM C595, C1157, AASHTO M240	Type IL
Portland Cement	ASTM C150, C1157, AASHTO M85	Type I, Type IA
Portland Cement	ASTM C150, C1157, AASHTO M85	Type II
Portland Cement	ASTM C150, C1157, AASHTO M85	Type III
Masonry Cement	ASTM C91	Type N, S, M

PRODUCT DESCRIPTION

This EPD reports environmental transparency information for five cement products, produced by Heidelberg Materials at their Nazareth PA facility. These 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. Cement is just one ingredient in the mixture that creates concrete, but it is the most chemically active ingredient and crucial to the quality of the final product. 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. Our Type IL is branded as **EcoCem®*PLC*** and was developed to be more environmentally friendly by reducing its carbon footprint (reduction measured through GWP). This product is a general use product for concrete and mortar as well as all the other various applications for cement**,** including engineered soils and solidification/stabilization of materials and wastes.

DECLARED UNIT

The declared unit is one metric tonne of Type I/Type IA, Type II, Type III, Type IL, Masonry (N, S, M) cement.

SYSTEM BOUNDARY

This EPD is a cradle-to-gate EPD covering A1-A3 stages of the life cycle.

Production Stage			Construction Stage		Use Stage							End Of Life Stage			
Extraction And Upstream Production	Transport To Factory	Manufacturing	Transport To Factory	Installation	Use	Maitenance	Repair	Replacement	Refurbishment	Operational Energy Use	Operational Water Use	Deconstruction / Demolition	Transport	Waste Processing	Disposal Of Waste
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4
x	x	x	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND

Note: MND = module not declared; X = module included.

CUT-OFF

Items excluded from 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); and
- energy and water use related to company management and sales activities that may be located either within the factory site or at another location.

ALLOCATION PROCEDURE

Allocation follows the requirements and guidance of ISO 14044:2006, Clause 4.3.4; NSF PCR:2020; and ISO 21930:2017 section 7.2. Recycling and recycled content is modeled using the cut-off rule.

This sub-category PCR recognizes fly ash, silica fume, granulated blast furnace slag, cement kiln dust, flue gas desulfurization (FGD) gypsum, and post-consumer 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.

REFERENCES

Global Cement and Concrete Association (GCCA) 2020. N.A. version of Industry EPD tool for Cement and Concrete. https://concrete-epd-tool.org/.
GCCA and PCA, GCCA Industry EPD Tool for Cement and Concrete (V3.1), LCA Model, North American version, Prepared by Quantis, November 2021.
ISO 21930:2017 Sustainability in buildings and civil engineering works — Core rules for environmental product declarations of construction products and services
ISO 14040:2006/Amd 1:2020 Environmental Management - Life Cycle Assessment - Principles and Framework
ISO 14044:2006/Amd 1:2017/Amd 2:2020 Environmental Management - Life Cycle Assessment - Requirements and Guidelines
NSF 2021: PCR for Portland, Blended, Masonry, Mortar and Plastic (Stucco) Cements v3.2, September 2021
USLCI: 2015 The U.S. Life Cycle Inventory Database
WBCSD CSI 2013: CO2 and Energy Protocol Version 3.1 of 9 December 2013; https://www.cement-co2-protocol.org/en/
WCI: 2010 WCI, Final Essential Requirements of Mandatory Reporting

CEMENT TYPES

For portland cement types, ASTM C150 describes:

Cement Type	Description
Type I	Normal
Type IA	Normal Air-entraining
Type II	Moderate Sulfate Resistance
Type III	High Early Strength

For blended hydraulic cements – specified by ASTM C595 – the following nomenclature is used:

Cement Type	Description
Type IL	Portland-Limestone Cement

In addition, some blended cements have special performance properties verified by additional testing. These are designated by letters in parentheses following the cement type. For example Type IP(MS) is a portland-pozzolan cement with moderate sulfate resistance properties. Others are designated by (HS), for high sulfate resistance; (A), for air-entraining cements; (MH) for moderate heat of hydration; and (LH) for low heat of hydration. See ASTM C595 for more info.

For performance-based specifications, ASTM C1157 describes cements by their performance attributes:

Cement Type	Description
Type GU	General Use
Type HE	High Early-Strength
Type MS	Moderate Sulfate Resistance
Type HS	High Sulfate Resistance
Type MH	Moderate Heat of Hydration
Type LH	Low Heat of Hydration

LIFE CYCLE IMPACT ASSESSMENT RESULTS – Nazareth Cement Products: Type IL named EcoCem®PLC, Type I/Type IA, and Type II; per 1 metric tonne

Impact Assessment	Unit	Type IL	Type I /Type 1A	Type II
Global warming potential (GWP)[1]	kg CO_2 eq	**809.63**	**860.69**	**862.55**
Depletion potential of the stratospheric ozone layer (ODP)	kg CFC-11 eq	**2.55E-05**	**2.84E-05**	**2.68E-05**
Eutrophication potential (EP)	kg N eq	**0.76**	**0.83**	**0.79**
Acidification potential of soil and water sources (AP)	kg SO_2 eq	**2.15**	**2.32**	**2.28**
Formation potential of tropospheric ozone (POCP)	kg O_3 eq	**27.63**	**30.17**	**29.22**
Resource Use				
Abiotic depletion potential for non-fossil mineral resources (ADPelements)*	kg Sb eq	**1.26E-04**	**1.76E-04**	**1.29E-04**
Abiotic depletion potential for fossil resources (ADPfossil)	MJ, NCV	**673.06**	**730.20**	**711.81**
Renewable primary energy resources as energy (fuel), (RPRE)*	MJ, NCV	**40.78**	**349.18**	**42.39**
Renewable primary resources as material, (RPRM)*	MJ, NCV	**0.00**	**704.20**	**0.00**
Non-renewable primary resources as energy (fuel), (NRPRE)*	MJ, NCV	**5496.89**	**5996.47**	**5817.50**
Non-renewable primary resources as material (NRPRM)*	MJ, NCV	**0.00**	**1.65**	**0.00**
Consumption of fresh water	m3	**0.94**	**1.14**	**0.99**
Secondary Material, Fuel and Recovered Energy				
Secondary Materials, (SM)*	kg	**0.02**	**40.00**	**20.00**
Renewable secondary fuels, (RSF)*	MJ, NCV	**0.00**	**0.00**	**0.00**
Non-renewable secondary fuels (NRSF)*	MJ, NCV	**0.00**	**0.00**	**0.00**
Recovered energy, (RE)*	MJ, NCV	**-**	**-**	**0.00**
Waste & Output Flows				
Hazardous waste disposed*	kg	**0.00**	**0.00**	**0.00**
Non-hazardous waste disposed*	kg	**0.45**	**0.47**	**0.49**
High-level radioactive waste*	kg	**0.00**	**0.00**	**0.00**
Intermediate and low-level radioactive waste*[2]	kg	**0.00**	**0.00**	**0.00**
Components for reuse*	kg	**0.00**	**0.00**	**0.00**
Materials for recycling*	kg	**0.32**	**0.34**	**0.35**
Materials for energy recovery*	kg	**0.00**	**0.00**	**0.00**
Recovered energy exported from the product system*	MJ, NCV	**0.00**	**0.00**	**0.00**
Additional Inventory Parameters for Transparency				
CO_2 emissions from calcination and uptake from carbonation*	kg CO_2 eq	**451.50**	**472.71**	**483.00**
Biogenic CO_2, reporting the removals and emissions associated with biogenic carbon content contained within biobased products*	kg CO_2 eq	**0.00**	**0.00**	**0.00**

* Emerging LCA impact categories and inventory items are still under development and can have high levels of uncertainty that preclude international acceptance pending further development. Use caution when interpreting data in these categories.

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.

[1] GWP 100; 100-year time horizon GWP factors are provided by the IPCC 2013 Fifth Assessment Report (AR5).
CO2 from biomass secondary fuels (wood chips made from construction waste as well as whole wood construction waste) used in kiln are climate-neutral (CO2 sink = CO2 emissions), ISO 21930, 7.2.7.

LIFE CYCLE IMPACT ASSESSMENT RESULTS – Nazareth Cement Products: Type III and Masonry (S, N, M); per 1 metric tonne

Impact Assessment	Unit	Type III	Masonry
Global warming potential (GWP)[3]	kg CO_2 eq	871.06	505.55
Depletion potential of the stratospheric ozone layer (ODP)	kg CFC-11 eq	2.70E-05	1.73E-05
Eutrophication potential (EP)	kg N eq	0.80	0.59
Acidification potential of soil and water sources (AP)	kg SO_2 eq	2.30	1.36
Formation potential of tropospheric ozone (POCP)	kg O_3 eq	29.55	16.90
Resource Use			
Abiotic depletion potential for non-fossil mineral resources (ADPelements)*	kg Sb eq	1.29E-04	8.70E-05
Abiotic depletion potential for fossil resources (ADPfossil)	MJ, NCV	718.20	414.90
Renewable primary energy resources as energy (fuel), (RPRE)*	MJ, NCV	42.58	30.59
Renewable primary resources as material, (RPRM)*	MJ, NCV	0.00	0.00
Non-renewable primary resources as energy (fuel), (NRPRE)*	MJ, NCV	5864.51	3622.81
Non-renewable primary resources as material (NRPRM)*	MJ, NCV	0.00	0.00
Consumption of fresh water	m3	1.00	0.64
Secondary Material, Fuel and Recovered Energy			
Secondary Materials, (SM)*	kg	3.02	0.00
Renewable secondary fuels, (RSF)*	MJ, NCV	0.00	0.00
Non-renewable secondary fuels (NRSF)*	MJ, NCV	0.00	0.00
Recovered energy, (RE)*	MJ, NCV	-	-
Waste & Output Flows			
Hazardous waste disposed*	kg	0.00	0.00
Non-hazardous waste disposed*	kg	0.49	0.27
High-level radioactive waste*	kg	0.00	0.00
Intermediate and low-level radioactive waste*[4]	kg	0.00	0.00
Components for reuse*	kg	0.00	0.00
Materials for recycling*	kg	0.35	0.20
Materials for energy recovery*	kg	0.00	0.00
Recovered energy exported from the product system*	MJ, NCV	0.00	0.00
Additional Inventory Parameters for Transparency			
CO_2 emissions from calcination and uptake from carbonation*	kg CO_2 eq	488.25	273.00
Biogenic CO_2, reporting the removals and emissions associated with biogenic carbon content contained within biobased products*	kg CO_2 eq	0.00	0.00

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[2] GWP 100; 100-year time horizon GWP factors are provided by the IPCC 2013 Fifth Assessment Report (AR5).
CO2 from biomass secondary fuels (wood chips made from construction waste as well as whole wood construction waste) used in kiln are climate-neutral (CO2 sink = CO2 emissions), ISO 21930, 7.2.7.

ADDITIONAL ENVIROMENTAL INFORMATION

Environmental Management System (EMS)

The Nazareth Plant has an EMS in place. The EMS identifies environmental aspects and ensures that control procedures are continually updated to reflect current environmental knowledge and regulations. The EMS tracks major reporting, monitoring, and recordkeeping requirements. The primary purpose of the EMS is to provide notice of upcoming events or requirements, to record fulfillment of these tasks, and to aid in development of the reporting requirements. Also, environmental policies and procedures have been composed, which serve as a reference and provides operating personnel with environmental procedures.

For environmental reporting the plant complies with the US Environmental Protection Agency (EPA) and Pennsylvania Department of Environmental Protection (PADEP) requirements and emissions reports:

- Title V annual emission inventory program
- Greenhouse Gas Reporting (Part 98) – it is a comprehensive accounting of total greenhouse gas emissions from Plant sources.
- GCCA Cement Sustainability Initiative Cement CO2 and Energy Protocol, Version 3.1.

Air Permit

- The Nazareth Plant has an air quality permit with the Pennsylvania DEP – Title V Permit No.: 48-00004. Issued in accordance with the provisions of the Air Pollution Control Act, the Act of January 8, 1960, P.L. 2119, as amended, and 25 Pa. Code Chapter 127.

Used Oil, Waste Oil Products, Waste Chemicals and Anti-Freeze:

The Nazareth plant stores waste products in appropriate storage bins and containers and/or in containment areas. A third-party contractor removes the wastes and properly recycles or disposes the wastes per regulations. Communication of final disposal is given to the Nazareth plant.

Recycling Programs

The Nazareth plant has taken steps for appropriate storage and maintains third party contractors to pick up and recycle the following from the Nazareth plant and office operations: used batteries, discarded paper, wood pallets, outdated or damaged electronic hardware and parts, scrap metal, and others.

Heidelberg Materials Sustainability Commitments 2030

The world needs smart, sustainable and resilient infrastructure, buildings, and public spaces. At Heidelberg Materials, we are transforming our business to address these challenges, and are placing sustainability at the core of what we do.

The United Nations Sustainable Development Goals (SDGs) shape our strategy and sustainability commitments. Our Sustainability Commitments 2030 support our vision to build a more sustainable future that is net zero, safe and inclusive, nature positive, and circular and resilient. Learn more at Sustainability Commitments 2030 (heidelbergmaterials.com).