Environmental Product Declaration (EPD) for Packaged Cement

GENERAL INFORMATION

This cradle to gate Environmental Product Declaration covers four cement products produced and packaged at the Union Bridge 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

Union Bridge Cement Plant and Terminal

675 Quaker Hill Road

Union Bridge, MD 21791

PROGRAM OPERATOR

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

NRMCAEPD: 20043

DATE OF ISSUE

May 1, 2021 (valid for 5 years until May 1, 2026)

Environmental Impacts

Union Bridge Plant: Product-Specific Type III EPD

Declared Packaged Cement Products (four):
Type IL; Type I/II; Type III; Masonry

Declared Unit: One metric tonne of cement

	Packaged Cement Products			
	Type IL	Type I/II	Type III	Masonry
Global Warming Potential (kg CO_2-eq)	**810**	**865**	**886**	**501**
Ozone Depletion Potential (kg CFC-11-eq)	6.89E-06	6.39E-06	7.27E-06	5.47E-06
Eutrophication Potential (kg N-eq)	1.27	1.34	1.39	0.81
Acidification Potential (kg SO^2-eq)	1.30	1.31	1.40	0.90
Photochemical Ozone Creation Potential (kg O_3-eq)	30.7	32.6	33.4	19.5
Abiotic Depletion, nonfossil (kg Sb-eq)	7.90E-06	7.68E-06	8.14E-06	7.06E-06
Abiotic Depletion, fossil (MJ)	3,912	4,043	4,273	2,675
Product Components:				
Clinker	82%	90%	91%	48%
Limestone, Gypsum and Others	18%	10%	9%	52%

Additional detail and impacts are reported on page 5

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 V2: 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: Laurel McEwen, VP EPD Services • Climate Earth (www.climateearth.com)
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, formerly known as Lehigh Cement, a leading supplier of cementitious construction materials in North America, has been manufacturing cement in Maryland for more than 100 years, making us a pillar of the many communities around us and providing employment and economic benefit to small towns and cities. We now operate one cement plant in Union Bridge, a rural town in western Carroll County which went through a modernization phase in 2001. This modernization improved the environmental impacts through efficient and more sustainable production of clinker and cement. There is a packaging operation and warehouse at the Union Bridge plant. 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. Heidelberg Materials' vision is to reduce 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 for both bulk and packaged cement.

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 to surrounding areas. We also maintain a constant communication with local governments and councils to preserve a neighborly relationship, which we take very seriously. Through donations and participation in local events and charities, Heidelberg Materials continues to raise awareness of 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-II
Portland Cement	ASTM C150, C1157, AASHTO M85	Type III
Masonry Cement	ASTM C91	Type N, S

PRODUCT DESCRIPTION

This EPD reports environmental transparency information for four cement products, produced and packaged by Heidelberg Materials at the Union Bridge, MD 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 or mortar, 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 ton of packaged Type IL, Type I-II, Type III and Masonry 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.

LIFE CYCLE INVENTORY (LCI)

Primary Sources of LCI Data:

Coal: ecoinvent 3.5 (2018) "Hard coal {RNA}| hard coal mine operation and hard coal preparation | Cut-off, U"
Electricity: US-EI (2020) "Electricity, high voltage, at grid, eGrid (2018), RFC/US US-EI U"
Natural Gas: ecoinvent 3.5 (2018) "market for natural gas, high pressure US"
Petroleum Coke: US-EI (2020) "Petroleum coke, at refinery/US"
Sand: ecoinvent 3.5 (2018): "Silica sand {RoW}| production | Cut-off, U"
Train transport: USLCI (2015) "Transport, train, diesel powered/US"
Truck transport: USLCI (2015) "Transport, combination truck, long-haul, diesel powered, Northeast/tkm/RNA"
Truck transport: USLCI (2015) "Transport, combination truck, short-haul, diesel powered, Northeast/tkm/RNA"

The resource mix is: 35.1% Coal, 29.8% Nuclear, 28.5% Natural Gas, 3.0% Wind, 1.1% Hydro, 1.1% Biomass, 0.5% Oil, 0.2% Solar, 0.6% Other Fossil. The GWP for this resource mix is 0.66 kg CO2e/kWh.

REFERENCES

ACLCA 2019, Guidance to Calculating Non-LCIA Inventory Metrics in Accordance with ISO 21930:2017. The American Centre for Life Cycle Assessment, May 2019
Climate Earth 2021: Lehigh Cement – LCA Project Report, Union Bridge Plant ecoinvent v3.5: 2018 The Swiss Centre for Life Cycle Inventories
ISO 21930:2017 Sustainability in buildings and civil engineering works — Core rules for environmental product declarations of construction products and services
International Organization for Standardization. (2000). Environmental labels and declarations - General principles (ISO Standard No. 14020:2000). https://www.iso.org/standard/34425.html.
International Organization for Standardization. (2006). Environmental labels and declarations, Type III environmental declarations, Principles and procedures (ISO Standard No. 14025:2006). https://www.iso.org/standard/38131.html.
International Organization for Standardization. (2006). Environmental management - Life cycle assessment - Principles and framework (ISO Standard No. 14040:2006), https://www.iso.org/standard/37456.html.
International Organization for Standardization. (2017). Sustainability in buildings and civil engineering works - Core rules for environmental product declarations of construction products and services (ISO Standard No. 21930:2017), https://www.iso.org/standard/61694.html.
International Organization for Standardization. (2020). Environmental management - Life cycle assessment - Requirements and guidelines (ISO Standard No. 14044:2006/AMD 2:2020). https://www.iso.org/standard/76122.html.
Long Trail Sustainability. (2020). DATASMART (US-EI Database). Huntington, VT: Long Trail Sustainability NSF 2020: PCR for Portland, Blended, Masonry, Mortar and Plastic (Stucco) Cements v3.1, September 2020 USLCI: 2015 The U.S. Life Cycle Inventory Database

LIFE CYCLE IMPACT ASSESSMENT RESULTS – Union Bridge Packaged Cement Products: Type IL named EcoCem*PLC™*, Type I-II, Type III, Masonry; per 1 metric tonne

Impact Assessment	Unit	Type IL	Type I-II	Type III	Masonry
Global warming potential (GWP)[1]	kg CO_2 eq	**810**	**865**	**886**	**501**
Depletion potential of the stratospheric ozone layer (ODP)	kg CFC-11 eq	**6.89E-06**	**6.39E-06**	**7.27E-06**	**5.47E-06**
Eutrophication potential (EP)	kg N eq	**1.27**	**1.34**	**1.39**	**0.81**
Acidification potential of soil and water sources (AP)	kg SO_2 eq	**1.30**	**1.31**	**1.40**	**0.90**
Formation potential of tropospheric ozone (POCP)	kg O_3 eq	**30.7**	**32.6**	**33.4**	**19.5**
Resource Use					
Abiotic depletion potential for non-fossil mineral resources (ADPelements)*	kg Sb eq	**7.90E-06**	**7.68E-06**	**8.14E-06**	**7.06E-06**
Abiotic depletion potential for fossil resources (ADPfossil)	MJ, NCV	**3,933**	**4,043**	**4,273**	**2,675**
Renewable primary energy resources as energy (fuel), (RPRE)*	MJ, NCV	**345.3**	**338.7**	**347.8**	**345.7**
Renewable primary resources as material, (RPRM)*	MJ, NCV	**0**	**0**	**0**	**0**
Non-renewable primary resources as energy (fuel), (NRPRE)*	MJ, NCV	**4,627**	**4,622**	**4,997**	**3,260**
Non-renewable primary resources as material (NRPRM)*	MJ, NCV	**0**	**0**	**0**	**0**
Consumption of fresh water	m3	**3.40**	**3.04**	**3.54**	**2.99**
Secondary Material, Fuel and Recovered Energy					
Secondary Materials, (SM)*	kg	**319**	**343**	**340**	**185**
Renewable secondary fuels, (RSF)*	MJ, NCV	**0**	**0**	**0**	**0**
Non-renewable secondary fuels (NRSF)*	MJ, NCV	**0**	**0**	**0**	**0**
Recovered energy, (RE)*	MJ, NCV	**0**	**0**	**0**	**0**
Waste & Output Flows					
Hazardous waste disposed*	kg	**0**	**0**	**0**	**0**
Non-hazardous waste disposed*	kg	**0**	**0**	**0**	**0**
High-level radioactive waste*	kg	**3.75E-07**	**3.13E-07**	**3.91E-07**	**3.15E-07**
Intermediate and low-level radioactive waste*	kg	**1.88E-06**	**1.59E-06**	**1.96E-06**	**1.57E-06**
Components for reuse*	kg	**0**	**0**	**0**	**0**
Materials for recycling*	kg	**3.59E+02**	**3.75E+02**	**3.75E+02**	**2.91E+02**
Materials for energy recovery*	kg	**0**	**0**	**0**	**0**
Recovered energy exported from the product system*	MJ, NCV	**0**	**0**	**0**	**0**
Additional Inventory Parameters for Transparency					
CO_2 emissions from calcination and uptake from carbonation[2]	kg CO_2 eq	**441**	**484**	**485**	**257**
Biogenic CO_2, reporting the removals and emissions associated with biogenic carbon content contained within biobased products	kg CO_2 eq	**0**	**0**	**0**	**0**

* 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.

Product packaging waste per declared unit of Type I/II, Type III and Type IL cements include: 13.4 kg pallet waste, 0.23 kg stretch wrap waste, 0.66 kg paper waste.
Product packaging waste per declared unit of Masonry cement include: 13.4 kg pallet waste, 0.23 kg stretch wrap waste, 0.84 kg paper waste.

[1] GWP 100; 100-year time horizon GWP factors are provided by the IPCC 2013 Fifth Assessment Report (AR5). Total CO2 facility combustion emissions are measured data from CO2 Continuous Emission Monitoring System (CEMS).
[2] Calcination emissions were calculated based on the Cement CO2 and Energy Protocol detailed output method (B2) published by the World Business Council for Sustainable Development (WBCSD) Cement Sustainability Initiative (CSI).

ADDITIONAL ENVIROMENTAL INFORMATION

Environmental Management System (EMS)

The Union Bridge Plant has an EMS in place. The EMS identifies environmental impacts, permit requirements and ensures that control procedures are continually updated to reflect current environmental knowledge and regulations. Environmental policies and procedures are written in the EMS manual and on Spectrac. Spectrac is a Microsoft Access Program that contains all air, water, waste and regulatory permit requirements. The program sends email notifications and updates to the appropriate listed designee on a monthly, quarterly, and annual timeframe. Environmental reporting complies with the U.S. EPA and the state of Maryland Department of Environmental Protection.

Air Permit

- The Union Bridge Plant is a Title V facility. The Title V Air Permit lists all requirements for both State and Federal reporting requirements and emissions limits.

Recycling Programs

- Used Oil, waste oil filters, fluorescent bulbs, batteries, office, and cardboard paper and used anti-Freeze.

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).