

Environmental Product Declaration (EPD) for Cement Produced at Evansville Cement Plant

GENERAL INFORMATION

This cradle to gate Environmental Product Declaration covers six cement products produced at the Evansville 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.

LEHIGH CEMENT

Evansville Cement Plant
537 Evansville Rd
Fleetwood, PA 19522



PROGRAM OPERATOR

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

NRMCAEPD: 20053

DATE OF ISSUE

January, 17 2022 (valid for 5 years until January 17, 2027)

ENVIRONMENTAL IMPACTS

Lehigh Evansville Plant: Product-Specific Type III EPD

Declared Cement Products (six):

Type I/II; Type IS40; Masonry; Type III; Oil Well A; Oil Well G

Declared Unit: One metric tonne of cement

	CEMENT PRODUCTS					
	Type I/II	Type IS40	Masonry	Type III	Oil Well A	Oil Well G
Global Warming Potential (kg CO ₂ -eq)	841	531	497	841	882	882
Ozone Depletion Potential (kg CFC-11-eq)	2.86E-05	2.04E-05	1.95E-05	2.86E-05	2.95E-05	2.95E-05
Eutrophication Potential (kg N-eq)	0.92	0.74	0.71	0.92	0.94	0.94
Acidification Potential (kg SO ₂ -eq)	2.17	1.41	1.32	2.17	2.28	2.28
Photochemical Ozone Creation Potential (kg O ₃ -eq)	36.66	22.68	21.15	36.66	38.52	38.52
Abiotic Depletion, nonfossil (kg Sb-eq)	1.44E-04	1.08E-04	1.04E-04	1.44E-04	1.47E-04	1.47E-04
Abiotic Depletion, fossil (MJ)	757.06	475.60	44.47	757.06	793.80	793.80
Product Components:						
Clinker	93%	56%	52%	93%	98%	98%
Limestone, Gypsum and Others	7%	6%	48%	7%	2%	2%
Slag		38%				

Additional detail and impacts are reported on page 5 and 6

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@lehighhanson.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



Lehigh Cement, a leading supplier of cementitious construction materials in North America, 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 Lehigh Cement Company. The Evansville Plant now operates creating cement products with the goal to mitigate our environmental impacts. Lehigh Cement’s 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 HeidelbergCement’s vision of reducing greenhouse gas (GHG) emissions to have carbon neutral concrete by 2050, Lehigh 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
Blended Hydraulic Cement	ASTM C595, C1157, AASHTO M240	Type IS
Portland Cement	ASTM C150, C1157, AASHTO M85	Type I/II
Portland Cement	ASTM C150, C1157, AASHTO M85	Type III
Masonry Cement	ASTM C91	Type M, N, S
Oil Well Cement	API Spec 10A	Oil Well Class A, G

PRODUCT DESCRIPTION

This EPD reports environmental transparency information for six cement products, produced by Lehigh Cement at their Evansville 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 IS40 blended slag cement was developed to be more environmentally friendly by reducing its carbon footprint. This product is a general use product for concrete and other various applications for cement, including cast-in-place concrete, pre-cast, tilt-up, tanks, bridges, pavements, concrete masonry units, concrete products and soil and waste stabilization and solidification.



DECLARED UNIT

The declared unit is one metric tonne of Type I/II, Type IS40, Masonry (Type N, S, M), Type III, Oil Well (OW) Class A, and OW Class G

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 site	Installation	Use	Maintenance	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:2021; 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 II	Moderate Sulfate Resistance
Type II (MH)	Moderate Heat of Hydration (and Moderate Sulfate Resistance)
Type III	High Early Strength
Type IV	Low Heat Hydration
Type V	High Sulfate Resistance

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

Cement Type	Description
Type IL	Portland-Limestone Cement
Type IS	Portland-Slag Cement
Type IP	Portland-Pozzolan Cement
Type IT	Ternary Blended 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. Other special properties 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. Refer to ASTM C595 for more detail.

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 – Evansville Cement Products: Type I/II, Type IS40, Masonry; per 1 metric tonne

Impact Assessment	Unit	Type I/II	Type IS40	Masonry
Global warming potential (GWP) ¹	kg CO ₂ eq	840.88	530.82	496.99
Depletion potential of the stratospheric ozone layer (ODP)	kg CFC-11 eq	2.86E-05	2.04E-05	1.95E-05
Eutrophication potential (EP)	kg N eq	0.92	0.74	0.71
Acidification potential of soil and water sources (AP)	kg SO ₂ eq	2.17	1.41	1.32
Formation potential of tropospheric ozone (POCP)	kg O ₃ eq	36.66	22.68	21.15
Resource Use				
Abiotic depletion potential for non-fossil mineral resources (ADPelements)*	kg Sb eq	1.44E-04	1.08E-04	1.04E-04
Abiotic depletion potential for fossil resources (ADPfossil)	MJ, NCV	757.06	475.60	44.47
Renewable primary energy resources as energy (fuel), (RPRE)*	MJ, NCV	50.57	39.09	37.76
Renewable primary resources as material, (RPRM)*	MJ, NCV	0.00	0.00	0.00
Non-renewable primary resources as energy (fuel), (NRPRE)*	MJ, NCV	6029.60	4078.08	3861.79
Non-renewable primary resources as material (NRPRM)*	MJ, NCV	0.00	0.00	0.00
Consumption of fresh water	m ³	1.93	1.32	1.26
Secondary Material, Fuel and Recovered Energy				
Secondary Materials, (SM)*	kg	78.70	63.95	99.22
Renewable secondary fuels, (RSF)*	MJ, NCV	0.00	0.00	0.00
Non-renewable secondary fuels (NRSF)*	MJ, NCV	691.90	416.63	386.87
Recovered energy, (RE)*	MJ, NCV	-	-	-
Waste & Output Flows				
Hazardous waste disposed*	kg	0.00	0.00	0.00
Non-hazardous waste disposed*	kg	0.42	0.25	0.23
High-level radioactive waste*	kg	0.00	0.00	0.00
Intermediate and low-level radioactive waste*	kg	0.00	0.00	0.00
Components for reuse*	kg	0.00	0.00	0.00
Materials for recycling*	kg	0.00	0.00	0.00
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	442.93	266.71	247.66
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 – Evansville Cement Products: Type III, Oil Well Class A (OWA), Oil Well Class G (OWG); per 1 metric tonne

Impact Assessment	Unit	Type III	Oil Well A	Oil Well G
Global warming potential (GWP) ²	kg CO ₂ eq	840.88	882.22	882.22
Depletion potential of the stratospheric ozone layer (ODP)	kg CFC-11 eq	2.86E-05	2.95E-05	2.95E-05
Eutrophication potential (EP)	kg N eq	0.92	0.94	0.94
Acidification potential of soil and water sources (AP)	kg SO ₂ eq	2.17	2.28	2.28
Formation potential of tropospheric ozone (POCP)	kg O ₃ eq	36.66	38.52	38.52
Resource Use				
Abiotic depletion potential for non-fossil mineral resources (ADPelements)*	kg Sb eq	1.44E-04	1.47E-04	1.47E-04
Abiotic depletion potential for fossil resources (ADPfossil)	MJ, NCV	757.06	793.80	793.80
Renewable primary energy resources as energy (fuel), (RPRE)*	MJ, NCV	50.57	52.00	52.00
Renewable primary resources as material, (RPRM)*	MJ, NCV	0.00	0.00	0.00
Non-renewable primary resources as energy (fuel), (NRPRE)*	MJ, NCV	6029.60	6283.66	6283.66
Non-renewable primary resources as material (NRPRM)*	MJ, NCV	0.00	0.00	0.00
Consumption of fresh water	m ³	1.93	2.01	2.01
Secondary Material, Fuel and Recovered Energy				
Secondary Materials, (SM)*	kg	87.77	34.16	34.16
Renewable secondary fuels, (RSF)*	MJ, NCV	0.00	0.00	0.00
Non-renewable secondary fuels (NRSF)*	MJ, NCV	691.90	729.10	729.10
Recovered energy, (RE)*	MJ, NCV	-	-	-
Waste & Output Flows				
Hazardous waste disposed*	kg	0.00	0.00	0.00
Non-hazardous waste disposed*	kg	0.42	0.44	0.44
High-level radioactive waste*	kg	0.00	0.00	0.00
Intermediate and low-level radioactive waste*	kg	0.00	0.00	0.00
Components for reuse*	kg	0.00	0.00	0.00
Materials for recycling*	kg	0.00	0.00	0.00
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	442.93	466.75	466.75
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.

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 ENVIRONMENTAL INFORMATION

Environmental Management System (EMS)

The Evansville 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 Evansville Plant has an air quality permit with the Pennsylvania DEP – Title V Permit No.: 06-05002. 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 Evansville 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 Evansville plant.

Recycling Programs

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

Sustainability Commitments

Lehigh Cement, a Lehigh Hanson affiliated company, is a part of the HeidelbergCement Group, a leading construction materials company worldwide. HeidelbergCement's Sustainability Commitments 2030 define the key topics and core principles of Lehigh Cement's sustainability strategies, aligning with the UN Assembly Sustainable Development Goals (SDGs). Company sustainability performance ratings and ranking are publicly available at <https://www.heidelbergcement.com/en/sustainability-report>.

Lehigh Cement supports HeidelbergCement's Sustainability Commitments 2030. HeidelbergCement's goal of a 30% carbon footprint reduction as compared to 1990, encourages the discovery of innovative approaches and thought processes to reduce environmental impacts and ensure a sustainable business model. Working to incorporate knowledge and practices learned from global resources for local applications, Lehigh Cement continuously innovates to improve services and products that increase efficiency on the jobsite. Lehigh Cement also strives for effective management of all processes and resources and works with the local communities to promote resilient infrastructure and provide increased transparency. Lehigh Cement aligns and works globally with HeidelbergCement to push toward carbon neutral concrete by 2050. To learn more about Lehigh Cement's sustainability commitment, visit <https://www.lehighhanson.com/about/sustainability>.