Environmental Product Declaration (EPD) for Cement Produced at Mason City Cement Plant

GENERAL INFORMATION

This cradle to gate Environmental Product Declaration covers three cement products produced at the Mason City, IA 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

Mason City Cement Plant and Terminal
700 25th Street Northwest
Mason City, IA 50401

PROGRAM OPERATOR

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

NRMCAEPD: 20063

DATE OF ISSUE

July 22, 2022 (valid for 5 years until July 21, 2027)

ENVIRONMENTAL IMPACTS

Lehigh Mason City Plant: Product-Specific Type III EPD

Declared Packaged Cement Products (three):
Type IL; Type I; Type III

Declared Unit: One metric tonne of cement

	PACKAGED CEMENT PRODUCTS Type IL (ECOCEM PLC)	Type I	Type III
Global Warming Potential (kg CO_2-eq)	687	735	727
Ozone Depletion Potential (kg CFC-11-eq)	2.05E-05	2.17E-05	2.15E-05
Eutrophication Potential (kg N-eq)	1.31	1.38	1.37
Acidification Potential (kg SO^2-eq)	1.83	1.95	1.93
Photochemical Ozone Creation Potential (kg O_3-eq)	29.8	31.7	31.3
Abiotic Depletion, nonfossil (kg Sb-eq)	2.05E-04	2.14E-04	2.12E-04
Abiotic Depletion, fossil (MJ)	604	643	636
Product Components:			
Clinker	84.6%	91.3%	90.9%
Limestone, Gypsum and Others	15.4%	8.7%	9.1%

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 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 • Jack Geibig. • EcoForm Consulting

For additional explanatory material
Manufacture Representative: Jeff Hook (jeff.hook@lehighhanson.com)
This EPD was prepared using the pre-verified GCCA Tool by: 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 Company is among the leading producers of cement and cementitious materials with plants in the U.S. and Canada. Lehigh Cement's plant in Mason City, Iowa, began operations in 1911. The Mason City area was selected because of the availability of raw materials, including a large deposit of limestone and deposits of glacial till and blue clay. Since its early days of operation, the plant has undergone many expansions and rehabilitations with the last major one in 1976. The plant has continued to upgrade its equipment to mitigate its environmental impacts through the installation of a scrubber, SNCR system to control NOx emissions, and a CEMS monitoring system for stack emissions.

The onsite truck and rail terminal assists cement distribution, reaching markets in Iowa, Minnesota, Wisconsin and North Dakota. The Lehigh Cement plan in Mason City plays a critical role in North Central Iowa and Southern Minnesota concrete paving markets since counties recognize the beneficial life cycle offered by concrete overlays and new roadways. EcoCemPLC (Type IL) is the main cement being produced due to its reduction in embodied carbon for concrete. This product, along with the continuous focus on quality and alternative fuels (e.g., expired seed corn), demonstrates Lehigh Cement's commitment to more sustainable construction and environmental responsibility.

In addition, the Mason City plant team places a high priority on the safety of its employees, visitors and surrounding community. The Mason City team is active in the local community and supports local recreation leagues and charitable organizations.

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, AASHTO M240	Type IL
Portland Cement	ASTM C150, AASHTO M85	Type I
Portland Cement	ASTM C150, AASHTO M85	Type III

PRODUCT DESCRIPTION

This EPD reports environmental transparency information for three cement products, produced by Lehigh Cement at the Mason City, IA 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 IL, Type I and Type III 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 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.

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.

CUT-OFF CRITERIA

The cut-off criteria as per NSF PCR, Section 7.1.8 and ISO 21930, 7.1.8 were followed. 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 AND SOURCES

Gate-to-gate input/output flow data were collected for the following processes for the reference year 2020: Limestone quarry, clinker production and cement manufacture – Mason City, IA

All applicable North American background LCI data are publicly available in the GCCA LCA Database [4] - https://demo.gcca.quantis.solutions/.

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 [5].

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

1. ASTM C150 / C150M – 20 Standard Specification for Portland Cement.
2. ASTM C595 / C595M – 21 Standard Specification for Blended Hydraulic Cements
3. Global Cement and Concrete Association (GCCA) 2021. N.A. version of Industry EPD tool for Cement and Concrete – v3.1. https://concrete-epd-tool.org/
4. Global Cement and Concrete Association (GCCA) 2021. LCA Database, North American version – v3.1, Prepared by Quantis. https://demo.gcca.quantis.solutions/
5. Global Cement and Concrete Association (GCCA) 2021. LCA Model, North American version – v3.1, Prepared by Quantis https://demo.gcca.quantis.solutions/
6. ISO 21930:2017 Sustainability in buildings and civil engineering works — Core rules for environmental product declarations of construction products and services
7. ISO 14044:2006 Environmental Management - Life Cycle Assessment - Requirements and Guidelines
8. ISO 14040:2006 Environmental Management - Life Cycle Assessment - Principles and Framework
9. NSF 2020: PCR for Portland, Blended, Masonry, Mortar and Plastic (Stucco) Cements v3.2, September 2021
10. USLCI: 2015 The U.S. Life Cycle Inventory Database
11. WBCSD CSI 2013: CO2 and Energy Protocol Version 3.1 of 9 December 2013; https://www.cement-co2-protocol.org/en/
12. WCI: 2010 WCI, Final Essential Requirements of Mandatory Reporting

LIFE CYCLE IMPACT ASSESSMENT RESULTS – Mason City Cement Products: Type IL named EcoCem®PLC, Type I and Type III; per 1 metric tonne

Impact Assessment	Unit	Type IL	Type I	Type III
Global warming potential (GWP)[1]	kg CO_2 eq	**687**	**735**	**727**
Depletion potential of the stratospheric ozone layer (ODP)	kg CFC-11 eq	**2.05E-05**	**2.17E-05**	**2.15E-05**
Eutrophication potential (EP)	kg N eq	**1.31**	**1.38**	**1.37**
Acidification potential of soil and water sources (AP)	kg SO_2 eq	**1.83**	**1.95**	**1.93**
Formation potential of tropospheric ozone (POCP)	kg O_3 eq	**29.8**	**31.7**	**31.3**
Resource Use				
Abiotic depletion potential for non-fossil mineral resources (ADPelements)*	kg Sb eq	**2.05E-04**	**2.14E-04**	**2.12E-04**
Abiotic depletion potential for fossil resources (ADPfossil)	MJ, NCV	**604**	**643**	**636**
Renewable primary energy resources as energy (fuel), (RPRE)*	MJ, NCV	**191**	**201**	**199**
Renewable primary resources as material, (RPRM)*	MJ, NCV	**0.00**	**0.00**	**0.00**
Non-renewable primary resources as energy (fuel), (NRPRE)*	MJ, NCV	**4970**	**5290**	**5230**
Non-renewable primary resources as material (NRPRM)*	MJ, NCV	**0.00**	**0.00**	**0.00**
Consumption of fresh water	m3	**0.73**	**0.77**	**0.77**
Secondary Material, Fuel and Recovered Energy				
Secondary Materials, (SM)*	kg	**35.5**	**14.1**	**51.0**
Renewable secondary fuels, (RSF)*	MJ, NCV	**129**	**139**	**137**
Non-renewable secondary fuels (NRSF)*	MJ, NCV	**0.00**	**0.00**	**0.00**
Recovered energy, (RE)*	MJ, NCV	**0.00**	**0.00**	**0.00**
Waste & Output Flows				
Hazardous waste disposed*	kg	**0.00**	**0.00**	**0.00**
Non-hazardous waste disposed*	kg	**14.6**	**15.7**	**15.5**
High-level radioactive waste*	kg	**n/c**	**n/c**	**n/c**
Intermediate and low-level radioactive waste*[2]	kg	**n/c**	**n/c**	**n/c**
Components for reuse*	kg	**0.00**	**0.00**	**0.00**
Materials for recycling*	kg	**3.3**	**3.6**	**3.5**
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	**444**	**478**	**471**
Biogenic CO_2, reporting the removals and emissions associated with biogenic carbon content contained within biobased products*	kg CO_2 eq	**0.13**	**0.14**	**0.14**

* 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 (agriculture waste) used in kiln are climate-neutral (CO2 sink = CO2 emissions), ISO 21930, 7.2.7.
2 Not calculated by GCCA Tool

ADDITIONAL ENVIROMENTAL INFORMATION

Environmental Management System (EMS)

The Mason City Plant has an EMS in place. The EMS identifies environmental impacts and compliance requirements and ensures that these are continually updated to reflect current environmental knowledge and regulations. Environmental requirements are documented in the EMS which serves as a reference and provides operating personnel with relevant information and compliance deadlines. For environmental reporting the plant complies with the U.S. EPA and Iowa Department of Environmental Management requirements:

- Toxics Release Inventory (TRI) Program
- Greenhouse Gas Reporting Program
- Portland Cement MACT (40 CFR 63 Subpart LLL) Semi-annual Reporting
- Air Permit Compliance Monitoring Reporting, Compliance Certification, Emission Statement
- Toxic Substances Control Act (TSCA) Chemical Data Reporting
- NPDES Discharge Monitoring Reports

Air Permit

The Mason City Plant has been issued a Part 70 Title V Operating Permit from the Iowa Department of Natural Resources. The permit details all state and federal regulations and pollution control requirements applicable to the Mason City Plant.

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

The Mason City Plant stores these materials and wastes in appropriate storage containers in a containment area and in compliance with Spill Containment, Control and Countermeasure (SPCC) requirements. The facility maintains an SPCC Plan that is in compliance with all applicable regulations and has been certified by a Professional Engineer. A third-party contractor removes these wastes and properly recycles or disposes of them in accordance with Federal, State, and Local regulations. Documentation of final disposal is provided to the Mason City Plant.

Recycling Programs

The Mason City Plant has instituted a recycling program to ensure that the following materials are recycled: used batteries, spent fluorescent bulbs, discarded paper, cardboard, aluminum and other scrap metals, and outdated or damaged electronic hardware and parts. Used vehicle batteries are collected and sent off-site for recycling.

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.