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

GENERAL INFORMATION

This cradle to gate Environmental Product Declaration covers two cement products produced at the Redding 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

Redding Cement Plant and Terminal
15390 Wonderland Boulevard
Redding, CA 96003

PROGRAM OPERATOR

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

NRMCAEPD: 20040

DATE OF ISSUE

January 25, 2021 (valid for 5 years until January 25, 2026)

ENVIRONMENTAL IMPACTS

Lehigh Redding Plant: Product-Specific Type III EPD

Declared Cement Products (two):
Type I/II; Type II/V

Declared Unit: One metric tonne of cement

	CEMENT PRODUCTS Type I/II	Type II/V
Global Warming Potential (kg CO_2-eq)	*820*	*813*
Ozone Depletion Potential (kg CFC-11-eq)	*1.73E-05*	*1.72E-05*
Eutrophication Potential (kg N-eq)	*0.80*	*0.79*
Acidification Potential (kg SO_2-eq)	*1.68*	*1.62*
Photochemical Ozone Creation Potential (kg O_3-eq)	*45.1*	*43.6*
Abiotic Depletion, nonfossil (kg Sb-eq)	*4.22E-06*	*4.20E-06*
Abiotic Depletion, fossil (MJ)	*3,903*	*3,816*
Product Components:		
Clinker	*91%*	*91%*
Limestone, Gypsum and Others	*9%*	*9%*

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

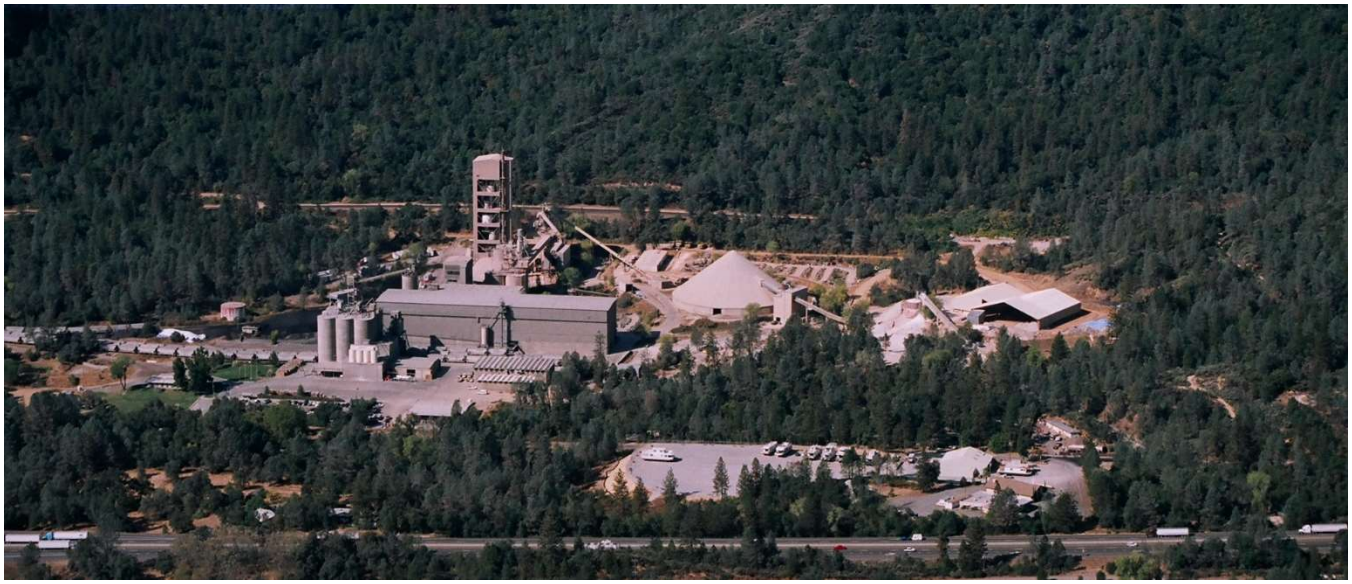
Third party verifier Thomas P. Gloria, PhD. (t.gloria@industrial-ecology.com) • Industrial Ecology Consultants

For additional explanatory material
Manufacture Representative: Morgan Johnson (**Morgan.Johnson@lehighhanson.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



Lehigh Cement, a Lehigh Hanson affiliated company (part of the HeidelbergCement Group) leading supplier of cementitious construction materials in North America, has been manufacturing cement in California for more than 80 years, making us a pillar of the many communities around us and providing employment and economic benefit to the state. We operate three cement plants in California, including a plant in Redding which began production in 1960. 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 offer 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 conservation of the natural environment are vital to our success. Currently, the recycling markets in California do not consume all of the waste tires that are generated in California. The Redding Plant plays a vital role in the beneficial reuse of tires in Northern California and Southern Oregon saving up to 10,000 metric tons of tires from being landfilled each year while replacing fossil fuels in its manufacturing of cement. The Redding Plant is able to use biomass to replace fossil fuels and further reduce GHG emissions from manufacturing by utilizing a variety of agricultural by-products including rice hulls, almond shells, and walnut flour. The Redding Plant has repeatedly been certified by the United States Environmental Protection Agency (US EPA)'s Energy Star program since the program's inception. Energy Star plant certification uses industry-specific performance indicators to assess how their energy use compares to plants with similar operating characteristics. Plants that are awarded the Energy Star designation have verified energy performance within the top 25% of plants in their respective industry.

PRODUCT

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

Product Type	Applicable Standard	Standard Designation
Portland Cement	ASTM C150, C1157, AASHTO M85	Type II/V
Portland Cement	ASTM C150, C1157, AASHTO M85	Type I/II

PRODUCT DESCRIPTION

This EPD reports environmental transparency information for two cement products, produced by Lehigh Cement at their Redding, California 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. These products are used 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/II and Type II/V cement.

SYSTEM BOUNDARY

This EPD is a cradle-to-gate EPD covering stages A1-A3 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 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); 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. Recycled and recovered materials with fuel content and used as fuels, such as scrap tires and agricultural waste, are considered non-renewable or renewable secondary fuels. Impacts allocated to these fuels are limited to the treatment and transport required for their use from point of generation along with all emissions from combustion.

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), WECC/US US-EI U”
Gypsum: US-EI (2020) “Gypsum, mineral, at mine/US”
Natural Gas: ecoinvent 3.5 (2018) “market for natural gas, high pressure US”
Petroleum Coke: US-EI (2020) “Petroleum coke, at refinery/US”
Train transport: USLCI (2008) “Transport, train, diesel powered/US”
Truck transport: USLCI (2015) “Transport, combination truck, long-haul, diesel powered, West/tkm/RNA”
Truck transport: USLCI (2015) “Transport, combination truck, short-haul, diesel powered, West/tkm/RNA”

Electricity grid mix includes: 29.78% natural gas, 23.87% hydro, 21.35% coal, 7.94% nuclear, 7.35% wind, 5.67% solar, 2.13% Geothermal, 0.41% other fossil, 0.15% other with a global warming potential of 0.501 kg CO2eq per /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, Redding 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
ISO 14020:2000 Environmental labels and declarations – General principles
ISO 14025:2006 Environmental labeling and declarations – Type III environmental declarations – Principles and procedures
ISO 14040:2006 Environmental Management - Life Cycle Assessment - Principles and Framework
ISO 14044:2006 Environmental Management - Life Cycle Assessment - Requirements and Guidelines
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 – Redding Cement Products: Type I/II and Type II/V; per 1 metric tonne

Impact Assessment	Unit	Type I/II	Type II/V
Global warming potential (GWP)[1]	kg CO_2 eq	**820**	**813**
Depletion potential of the stratospheric ozone layer (ODP)	kg CFC-11 eq	**1.73E-05**	**1.72E-05**
Eutrophication potential (EP)	kg N eq	**0.80**	**0.79**
Acidification potential of soil and water sources (AP)	kg SO_2 eq	**1.68**	**1.62**
Formation potential of tropospheric ozone (POCP)	kg O_3 eq	**45.1**	**43.6**
Resource Use			
Abiotic depletion potential for non-fossil mineral resources (ADP elements) *	kg Sb eq	**4.22E-06**	**4.20E-06**
Abiotic depletion potential for fossil resources (ADP fossil)	MJ, NCV	**3,903**	**3,816**
Renewable primary energy resources as energy (fuel), (RPRE[2]) *	MJ, NCV	**235**	**228**
Renewable primary resources as material, (RPRM[2]) *	MJ, NCV	**0**	**0**
Non-renewable primary resources as energy (fuel), (NRPRE[2]) *	MJ, NCV	**4,108**	**4,015**
Non-renewable primary resources as material, (NRPRM[2]) *	MJ, NCV	**0**	**0**
Consumption of fresh water, (FW[2])	m3	**1.99**	**1.94**
Secondary Material, Fuel and Recovered Energy			
Secondary Materials, (SM[2]) *	kg	**0**	**0**
Renewable secondary fuels, (RSF[2]) *	MJ, NCV	**0**	**0**
Non-renewable secondary fuels (NRSF[2]) *	MJ, NCV	**831**	**831**
Recovered energy, (RE[2]) *	MJ, NCV	**0**	**0**
Waste & Output Flows			
Hazardous waste disposed, (HW[2]) *	kg	**1.25E-02**	**1.25E-02**
Non-hazardous waste disposed, (NHWD[2]) *	kg	**2.27E-02**	**2.27E-02**
High-level radioactive waste, (HLRW[2]) *	kg	**1.11E-07**	**1.08E-07**
Intermediate and low-level radioactive waste, (ILLRW[2]) *	kg	**5.81E-07**	**5.66E-07**
Components for reuse, (CRU[2]) *	kg	**0**	**0**
Materials for recycling, (MR[2]) *	kg	**3.84E-03**	**3.84E-03**
Materials for energy recovery, (MER[2]) *	kg	**4.04E-02**	**4.04E-02**
Recovered energy exported from the product system, (EE[2]) *	MJ, NCV	**0**	**0**
Additional Inventory Parameters for Transparency			
CO_2 emissions from calcination and uptake from carbonation[3]	kg CO_2 eq	**399**	**399**
Biogenic CO_2, reporting the removals and emissions associated with biogenic carbon content contained within biobased products	kg CO_2 eq	**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.

[1] GWP 100; 100-year time horizon GWP factors are provided by the IPCC 2013 Fifth Assessment Report (AR5).

[2] Calculated per ACLCA ISO 21930 Guidance.

[3] Calculated from 2019 CO2 Continuous Emission Monitoring System (CEMS), Redding CA plant.

ADDITIONAL ENVIRONMENTAL INFORMATION

Environmental Management System (EMS)

The Redding Plant has an EMS in place. The EMS identifies environmental impacts and ensures that control procedures are continually updated to reflect current environmental knowledge and regulations for environmental reporting. The Redding plant complies with the US EPA, State of California, and Shasta County requirements and emissions reports:

- California Regulation for the Reporting of Criteria Air Pollutants and Toxic Air Contaminants (CTR)
- California Air Toxics Information and Assessment Act
- California Global Warming Solutions Act Cap-and-Trade Program and Mandatory Reporting of GHG emissions. Accredited Verifiers audit and certify the GHG emissions and covered product data. Selection of new verifiers occurs every 6 years.
- US EPA Greenhouse Gas Mandatory Reporting Rule
- World Business Council for Sustainable Development Cement Sustainability Initiative Cement CO_2 and Energy Protocol, Version 3.1.
- US EPA Portland Cement Manufacturing Industry National Emission Standard for Hazardous Air Pollutants
- US EPA New Source Performance Standards for Portland Cement Manufacturing Industry and Non-metallic Mineral Processing
- California Statewide General Permit for Storm Water Discharges Associated with Industrial Activities

Air Permit

- The Redding Plant has a Title V air permit issued by the Shasta County Air Quality Management District (#02-VP-07a).

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

The Redding plant stores these wastes in appropriate storage tanks, bins, and containers in a containment area. A licensed third-party contractor removes this waste and properly disposes of it per local and federal regulations.

Recycling Programs

The Redding plant recycles the following: used batteries, used vehicle batteries, used tires, discarded paper and cardboard, outdated or damaged electronic hardware parts, vapor lightbulbs and spent aerosol cans.

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.