CEMEX Victorville Cement Plant
Environmental Product Declaration

https://www.cemexusa.com
GENERAL INFORMATION

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

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Victorville Cement Plant
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EPD 280
November 19 2021
Valid for 5 years

LCA/EPD DEVELOPER
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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 V3.1 serves as the sub-category PCR
Inclusion of API SPEC 10A under the scope of PCA PCR effective 9/11/2020 per NSF Deviation #2020-037

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: Anand Krishnan (anand.krishnan@cemex.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
CEMEX is one of the largest building materials companies in the world with operations in the Americas, the Caribbean, Europe, Africa, Middle East, and Asia. CEMEX employs over 41,000 employees worldwide and is committed to sustainable practices and CO2 reduction goals in the communities in which it operates. CEMEX Victorville cement plant has been producing high quality products for over 100 years and employs approximately 210 people at the plant. The plant has an annual cement production capacity of over 3 million tons and provides cement for the construction needs in the states of California, Nevada, and Arizona.

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

<table>
<thead>
<tr>
<th>Product Type</th>
<th>Applicable Standard</th>
<th>Standard Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portland Limestone Cement</td>
<td>ASTM C595, C1157, AASHTO M240</td>
<td>Type IL</td>
</tr>
<tr>
<td>Plastic (Stucco) Cement</td>
<td>ASTM C1328, C1328M</td>
<td>Stucco</td>
</tr>
<tr>
<td>Portland Cement</td>
<td>ASTM C150, C1157, AASHTO M85</td>
<td>Type II/V</td>
</tr>
</tbody>
</table>

This EPD reports environmental information for three cement products produced by CEMEX at their Victorville, CA facility. Type II/V cement is used as the key ingredient in many products such as ready-mix concrete and in a wide array of applications such as concrete pipes, pre-stressed concrete, roads, foundations, bridges, soil stabilization, roof tile and more. Type IL cement is a general use cement engineered to reduce the carbon footprint by integrating a higher ground limestone content than permitted in Type II/V cement. Plastic (Stucco) cement refers to Portland cement-based plasters used for exterior and interior application in structures in a wide range of environments. This is a hydraulic cement used in mortar and grout for masonry construction.

PRODUCT COMPONENTS

<table>
<thead>
<tr>
<th>Inputs</th>
<th>Type IL</th>
<th>Stucco</th>
<th>Type II/V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinker</td>
<td>82%</td>
<td>72%</td>
<td>91%</td>
</tr>
<tr>
<td>Limestone, Gypsum &amp; other</td>
<td>18%</td>
<td>28%</td>
<td>9%</td>
</tr>
</tbody>
</table>

DECLARED UNIT
The declared unit is one metric tonne of Type IL, Stucco, and Type II/V cement.

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

<table>
<thead>
<tr>
<th>PRODUCTION Stage (Mandatory)</th>
<th>CONSTRUCTION Stage</th>
<th>USE STAGE</th>
<th>END-OF-LIFE Stage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extraction and upstream production</td>
<td>Transport to factory</td>
<td>Manufacturing</td>
<td>Transport to site</td>
</tr>
<tr>
<td>Transport to site</td>
<td>Installation</td>
<td>Use</td>
<td>Maintenance</td>
</tr>
<tr>
<td>Replacement</td>
<td>Refurbishment</td>
<td>De-construction/ Demolition</td>
<td>Transport to waste processing or disposal</td>
</tr>
<tr>
<td>Disposal of waste</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>A1</th>
<th>A2</th>
<th>A3</th>
<th>A4</th>
<th>A5</th>
<th>B1</th>
<th>B2</th>
<th>B3</th>
<th>B4</th>
<th>B5</th>
<th>C1</th>
<th>C2</th>
<th>C3</th>
<th>C4</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>X</td>
<td>X</td>
<td>MND</td>
<td>MND</td>
<td>MND</td>
<td>MND</td>
<td>MND</td>
<td>MND</td>
<td>MND</td>
<td>MND</td>
<td>MND</td>
<td>MND</td>
<td>MND</td>
</tr>
</tbody>
</table>

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. Recycled and recovered materials with fuel content and used as fuels, such as scrap tires and agricultural waste, are considered nonrenewable 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”
- **Diesel:** US-EI (2020) "Diesel, combusted in industrial equipment/US"
- **Limestone:** Manufacture specific primary data (2020)
- **Natural Gas:** ecoinvent 3.5 (2018) Market for natural gas, high pressure US"
- **Petroleum Coke:** US-EI (2020) "Petroleum coke, at refinery 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.
## LIFE CYCLE IMPACT ASSESSMENT RESULTS

Victorville Cement Products, bulk shipped: Type IL, Stucco, and Type II/V; per 1 metric tonne

<table>
<thead>
<tr>
<th>Impact Assessment</th>
<th>Unit</th>
<th>Type IL</th>
<th>Stucco</th>
<th>Type II/V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global warming potential (GWP)¹</td>
<td>kg CO₂ eq</td>
<td>808</td>
<td>720</td>
<td>875</td>
</tr>
<tr>
<td>Depletion potential of the stratospheric ozone layer (ODP)</td>
<td>kg CFC-11 eq</td>
<td>9.82E-06</td>
<td>8.94E-06</td>
<td>1.05E-05</td>
</tr>
<tr>
<td>Eutrophication potential (EP)</td>
<td>kg N eq</td>
<td>0.34</td>
<td>0.32</td>
<td>0.35</td>
</tr>
<tr>
<td>Acidification potential of soil and water sources (AP)</td>
<td>kg SO₂ eq</td>
<td>0.85</td>
<td>0.81</td>
<td>0.88</td>
</tr>
<tr>
<td>Formation potential of tropospheric ozone (POCP)</td>
<td>kg O₃ eq</td>
<td>13.6</td>
<td>12.8</td>
<td>14.3</td>
</tr>
</tbody>
</table>

### Resource Use

- Abiotic depletion potential for non-fossil mineral resources (ADPelements)*        | kg Sb eq | 4.34E-06 | 4.17E-06 | 4.50E-06 |
- Abiotic depletion potential for fossil resources (ADPfossil)                      | MJ, NCV  | 4,684    | 4,298   | 5,008     |
- Renewable primary energy resources as energy (fuel), (RPRE²)*                    | MJ, NCV  | 230      | 238     | 217       |
- Renewable primary resources as material, (RPRM²)*                               | MJ, NCV  | 0        | 0       | 0         |
- Non-renewable primary resources as energy (fuel), (NRPRE²)*                     | MJ, NCV  | 4,903    | 4,523   | 5,221     |
- Non-renewable primary resources as material, (NRPRM²)*                          | MJ, NCV  | 0        | 0       | 0         |
- Consumption of fresh water, (FW²)                                               | m³       | 2.64     | 2.55    | 2.63      |

### Secondary Material, Fuel and Recovered Energy

- Secondary Materials, (SM²) *                  | kg       | 1.10    | 0.95   | 1.21      |
- Renewable secondary fuels, (RSF²) *          | MJ, NCV  | 381     | 332    | 418       |
- Non-renewable secondary fuels (NRSF²) *      | MJ, NCV  | 140     | 123    | 154       |
- Recovered energy, (RE²) *                    | MJ, NCV  | 0       | 0      | 0         |

### Waste & Output Flows

- Hazardous waste disposed, (HW²) *          | kg       | 1.08E-03| 1.02E-03| 1.13E-03 |
- Non-hazardous waste disposed, (NHWD²) *    | kg       | 0.24    | 0.22   | 0.25      |
- High-level radioactive waste, (HLRW²) *     | kg       | 1.19E-07| 1.21E-07| 1.15E-07 |
- Intermediate and low-level radioactive waste, (ILLRW²) * | kg | 6.42E-07 | 6.47E-07 | 6.33E-07 |
- Components for reuse, (CRU²) *             | kg       | 0       | 0      | 0         |
- Materials for recycling, (MR²) *           | kg       | 2.34E-02| 2.21E-02| 2.45E-02 |
- Materials for energy recovery, (MER²) *     | kg       | 2.71E-02| 2.56E-02| 2.83E-02 |
- Recovered energy exported from the product system, (EE²) *                     | MJ, NCV  | 0       | 0      | 0         |

### Additional Inventory Parameters for Transparency

- CO₂ emissions from calcination and uptake from carbonation³ | kg CO₂ eq | 459 | 401 | 504 |
- Biogenic CO₂ reporting the removals and emissions associated with biogenic carbon content contained within biobased products⁴ | kg CO₂ eq | 0 | 0 | 0 |

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¹ GWP 100; 100-year time horizon GWP factors are provided by the IPCC 2013 Fifth Assessment Report (AR5).
² CO₂ from biogenic secondary fuels used in kiln are climate-neutral (CO₂ sink = CO₂ emissions), ISO 21930, 7.2.7.
³ Calculated per ACLCA ISO 21930 Guidance.
⁴ 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).

* 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.

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LIFE CYCLE ASSESSMENT

LIFE CYCLE IMPACT ASSESSMENT RESULTS
Victorville Cement Products, bag shipped: Stucco and Type II/V; per 1 metric tonne

<table>
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<tr>
<th>Impact Assessment</th>
<th>Unit</th>
<th>Stucco</th>
<th>Type II/V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global warming potential (GWP)(^5)</td>
<td>kg CO(_2) eq</td>
<td>728</td>
<td>883</td>
</tr>
<tr>
<td>Depletion potential of the stratospheric ozone layer (ODP)</td>
<td>kg CFC-11 eq</td>
<td>9.31E-06</td>
<td>1.08E-05</td>
</tr>
<tr>
<td>Eutrophication potential (EP)</td>
<td>kg N eq</td>
<td>0.34</td>
<td>0.37</td>
</tr>
<tr>
<td>Acidification potential of soil and water sources (AP)</td>
<td>kg SO(_2) eq</td>
<td>0.86</td>
<td>0.93</td>
</tr>
<tr>
<td>Formation potential of tropospheric ozone (POCP)</td>
<td>kg O(_3) eq</td>
<td>13.5</td>
<td>15.0</td>
</tr>
</tbody>
</table>

**Resource Use**

| Abiotic depletion potential for non-fossil mineral resources (ADPelem)\(^*\) | kg Sb eq | 6.63E-06 | 6.96E-06 |
| Abiotic depletion potential for fossil resources (ADPfossil)                | MJ, NCV  | 4,401     | 5,111     |
| Renewable primary energy resources as energy (fuel), (RPRE)\(^*\)           | MJ, NCV  | 416       | 394       |
| Renewable primary energy resources as material, (RPRE)\(^*\)               | MJ, NCV  | 0         | 0         |
| Non-renewable primary energy resources as energy (fuel), (NPRE)\(^*\)       | MJ, NCV  | 4,645     | 5,343     |
| Non-renewable primary energy resources as material, (NRPRE)\(^*\)           | MJ, NCV  | 0         | 0         |
| Consumption of fresh water, (FW)\(^6\)                                     | m\(^3\)   | 3.97      | 4.05      |

**Secondary Material, Fuel and Recovered Energy**

| Secondary Materials, (SM)\(^*\)                                     | kg        | 0.95      | 1.21      |
| Renewable secondary fuels, (RSF)\(^*\)                              | MJ, NCV   | 332       | 418       |
| Non-renewable secondary fuels (NRSF)\(^*\)                          | MJ, NCV   | 123       | 154       |
| Recovered energy, (RE)\(^*\)                                       | MJ, NCV   | 0         | 0         |

**Waste & Output Flows**

| Hazardous waste disposed, (HW)\(^*\)                                | kg        | 1.02E-03  | 1.13E-03  |
| Non-hazardous waste disposed, (NHWD)\(^*\)                         | kg        | 0.22      | 0.25      |
| High-level radioactive waste, (HLRW)\(^*\)                         | kg        | 1.31E-07  | 1.25E-07  |
| Intermediate and low-level radioactive waste, (ILLRW)\(^*\)        | kg        | 6.96E-07  | 6.81E-07  |
| Components for reuse, (CRU)\(^*\)                                  | kg        | 0         | 0         |
| Materials for recycling, (MR)\(^*\)                                | kg        | 2.21E-02  | 2.45E-02  |
| Materials for energy recovery, (MER)\(^*\)                         | kg        | 2.56E-02  | 2.83E-02  |
| Recovered energy exported from the product system, (EE)\(^*\)       | MJ, NCV   | 0         | 0         |

**Additional Inventory Parameters for Transparency**

| CO\(_2\) emissions from calcination and uptake from carbonation\(^7\) | kg CO\(_2\) eq | 401 | 504 |
| Biogenic CO\(_2\) reporting the removals and emissions associated with biogenic carbon content contained within biobased products\(^8\) | 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.

\(^5\) GWP 100; 100-year time horizon GWP factors are provided by the IPCC 2013 Fifth Assessment Report (AR5). CO\(_2\) from biogenic secondary fuels used in kiln are climate-neutral (CO\(_2\) sink = CO\(_2\) emissions), ISO 21930, 7.2.7.

\(^6\) Calculated per ACLCA ISO 21930 Guidance.

\(^7\) 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).

\(^8\) Type IL, biogenic CO\(_2\)=0 (-31.6kg CO\(_2\)+31.6 CO\(_2\)), Type II/V, biogenic CO\(_2\)=0 (-34.7kg CO\(_2\)+34.7 CO\(_2\)), Type Stucco, biogenic CO\(_2\)=0 (-27.6/+27.6 CO\(_2\)).
CEMEX unveiled a low-emission, high-efficiency locomotive at the Victorville, CA cement plant in 2019 as part of its continued commitment to sustainability and to enhance air quality in a community where it has operated for more than 100 years. This locomotive lowered emissions by more than 80% and fuel consumption by 25%.

CEMEX Victorville Cement Plant has other initiatives on site promoting sustainability and conservation. The plant is home to four wind turbines that offset thousands of tons of emissions each year. The plant is reducing greenhouse gas emissions and landfill waste by replacing close to 20% of traditional fuels with alternative and renewable resources.
REFERENCES

Climate Earth 2021: CEMEX USA – LCA Project Report, Victorville Plant
ecoinvent v3.5: 2018 The Swiss Centre for Life Cycle Inventories
ISO 14020:2000 Environmental labels and declarations – General principles
ISO 14025:2006 Environmental labeling and declarations – Type III environmental declarations – Principles and procedures
ISO 21930:2017 Sustainability in buildings and civil engineering works – Core rules for environmental product declarations of construction products and services
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
Ashworth Leininger Group – CEMEX Construction Materials Pacific LLC – Victorville Plant Verification Report