Environmental Product Declaration (EPD) for Concrete

About Cementos Argos Panama

Argos Panamá S.A. is a Panamanian cement and concrete supplier that is the market leader in the country. Through its network of ten Argos concrete plants located in the country, its annual concrete production reaches 480,000 m³. As for cement, its installed capacity is of 1,340,280 tons per year.

Argos Panamá S.A. is part of Cementos Argos S.A., a company whose headquarters are located in Colombia. For the second consecutive year, Argos has been included in the Dow Jones Sustainability Index.

Cementos Argos Panama
Torre Argos, 5th floor.
Juan Díaz, Complejo Santa María Business District
Llano Bonito, Ciudad de Panamá

Planta Miraflores
Transístmica, Vía Simón Bolívar, Ciudad de Panamá

EPD Program Operator
National Ready Mixed Concrete Association
900 Spring Street, Silver Spring, MD 20910
301-587-1400
www.nrmca.org/sustainability

Date of Issue: November 12, 2014
Period of Validity: 5 years
(untll November 12, 2019)
Declaration#: NRMCAEPD:10005
## NRMCA Certified Environmental Product Declaration

This environmental product declaration was conducted in accordance with ISO 14025:2006

- **Internal Verification**
- **External Verification**

### Declared Product:
This Environmental Product Declaration (EPD) covers 2 concrete mixes produced at the Miraflores concrete plant owned and operated by Cementos Argos Panama in Panama.

### Declaration Owner:
**Cementos Argos Panamá**  
Torre Argos, 5th floor.  
Juan Díaz, Complejo Santa María  
Business District  
Llano Bonito, Ciudad de Panamá  
(507) 366-1690  
www.argos.co/panama

### Program Operator:
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### LCA and EPD Developer:
**PRé**  
(202) 728-5087  
www.pre-sustainability.com/

### Independent Verifier:
Climate Earth, Inc.  
415-391-2725  
www.climateearth.com

### Product Category Rule:
Product Category Rules (PCR) for ISO 14025 Type III Environmental Product Declarations (EPDs) for Concrete meeting the requirements of one of the following:  

### Date of Issue:
November 12, 2014

### Period of Validity:
5 Years (until November 12, 2019)

### EPD Number:
NRMCAEPD:10005
ENVIRONMENTAL PRODUCT DECLARATION: DETAILED VERSION

Product Description
Products covered by this Environmental Product Declaration (EPD) are for general purpose concrete for commercial applications developed and produced by Cementos Argos Panama at Miraflores Plant. This EPD reports the impacts for the product “ready-mix concrete” meeting the following specifications:

- ASTM C94: Standard Specification for Ready-Mixed Concrete
- UNSPSC code 30111500 Ready Mix Concrete
- Concrete CSI Section 03 30 00: Cast-in-Place

Product Components

<table>
<thead>
<tr>
<th>Component</th>
<th>Standard</th>
<th>Specification for:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portland Cement</td>
<td>ASTM C1157</td>
<td>Hydraulic Cement</td>
</tr>
<tr>
<td>Fly Ash</td>
<td>ASTM C618</td>
<td>Coal fly ash and raw or calcined Natural pozzolan for use in concrete</td>
</tr>
<tr>
<td>Slag Cement</td>
<td>ASTM C989</td>
<td>Slag cement for use in concrete and mortars</td>
</tr>
<tr>
<td>Natural and Crushed Aggregates</td>
<td>ASTM C33</td>
<td>Concrete aggregates</td>
</tr>
<tr>
<td>Admixtures</td>
<td>ASTM C494</td>
<td>Chemical Admixtures for Concrete</td>
</tr>
<tr>
<td>Batch Water</td>
<td>ASTM C1602</td>
<td>Mixing water used in the production of hydraulic cement concrete</td>
</tr>
</tbody>
</table>

Declared Unit
The declared unit is 1m$^3$ of Argos concrete that corresponds to the Argos mix numbers and plants given in the tables below:

<table>
<thead>
<tr>
<th>Mix Code</th>
<th>Strength Class (psi)</th>
<th>Slump (in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10014375</td>
<td>4000 @ 28 days</td>
<td>5 ± 1½</td>
</tr>
<tr>
<td>10019170</td>
<td>8000 @ 56 days</td>
<td>8½ ± 1½</td>
</tr>
</tbody>
</table>

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**Life Cycle Assessment (LCA)**

The LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks.

A summary of the life cycle stages included in the EPD is as follows:

1. **Raw Material Supply (upstream processes):** Extraction, handling and processing of the raw materials used in production of concrete: cement, supplementary cementitious materials, aggregate (course and fine), water, admixtures and other materials or chemicals used in concrete mixtures.
2. **Transportation:** Transportation of these materials from supplier to the ‘gate’ of the concrete producer.
3. **Manufacturing (core processes):** The core processes result from the energy used to store, batch, mix and distribute the concrete and operate the facility (concrete plant).
4. **Water use in mixing and distributing concrete.**

A summary of life cycle stages excluded from the EPD is as follows:

1. **Transportation to the construction site.**
2. **Construction (reinforcement, forming, placing, curing, etc.).**
3. **Building use and maintenance.**
4. **End of life.**

Additionally, the following cycle processes are excluded from this study:

1. Production, manufacturer and construction of buildings’ capital goods and infrastructure.
2. Production and manufacture of concrete production equipment, concrete delivery vehicles, earthmoving equipment, and laboratory equipment.

3. **Personnel-related activities (travel, furniture, office supplies).**
4. **Energy and water use related to company management and sales activities, which may be located either within the factory site or at another location.**

A summary of the limitations of this EPD include:

1. **This EPD does not report all of the environmental impacts due to manufacturing of the product, but rather reports the environmental impacts for those categories with established life cycle assessment based methods to track and report. Unreported environmental impacts include (but are not limited to) factors attributable to human health, land use change, water use in the upstream manufacturing process and habitat destruction.**
2. **This EPD report the results of an LCA for ‘cradle-to-gate’ analysis. Thus, declarations are not comparative assertions defined as an environmental claim regarding the superiority or equivalence of one product versus a competing product that performs the same function. An EPD does not make any statements that the product covered by the EPD is better or worse than any other product.**
3. **In order to assess the local impacts of product manufacturing, additional analysis is required.**
4. **The product manufacturer has the option of declaring additional information about their product including conformance with any other sustainability certification programs that often have performance and prescriptive requirements that aim to illustrate environmental best practices that cannot be captured by LCA.**
5. **Life Cycle Impact Assessment results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks.**
EPDs of concrete mixes may not be comparable if they do not comply with this standard and data from this EPD. The data cannot be used to compare between concrete mixes, construction products or concrete mixtures used in different concrete products unless the data is integrated into a comprehensive LCA. For example, precast concrete, concrete masonry units and site cast concrete all have different manufacturing processes whose impacts are attributed to different LCA stages. This precludes direct comparison between mixtures used in these different products unless all life cycle phases are included. Additionally, environmental declarations from different programs may not be comparable. More information about the NRMCA program can be found at http://www.nrmca.org/sustainability/EPDProgram/.

**Data Quality and Variability**

This EPD was created using plant specific data for upstream materials. Potential variations due to supplier locations, manufacturing processes and efficiencies and fuel use are thus accounted for in this EPD.

**Data Sources**

Data for this study came from several different sources and primary data was collected for foreground processes wherever possible. This section provides a qualitative and quantitative description of data, sources of generic data or literature, validation of data (including data quality assessment) and allocation principals and procedures. Data is assessed on the following five data quality indicators: Technological Representativeness, Geographical Representativeness, Temporal Representativeness, Completeness and Reliability. Gross Calorific Values (GCV) were used where applicable.

<table>
<thead>
<tr>
<th>Process</th>
<th>LCI Data Source</th>
<th>Geography</th>
<th>Year</th>
<th>Data Quality Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aggregates</td>
<td>Limestone, at mine (USLCI)</td>
<td>US</td>
<td>2008</td>
<td>• <strong>Technology</strong>: good&lt;br&gt;Process represents extraction of aggregates&lt;br&gt;• <strong>Time</strong>: fair&lt;br&gt;Data is within ten years&lt;br&gt;• <strong>Geography</strong>: very good&lt;br&gt;• <strong>Completeness</strong>: very good&lt;br&gt;Data is based on national average&lt;br&gt;• <strong>Reliability</strong>: good&lt;br&gt;Data is from USLCI database</td>
</tr>
<tr>
<td>Batch Water</td>
<td>Primary</td>
<td>Panama</td>
<td>2014</td>
<td>• <strong>Technology</strong>: very good&lt;br&gt;Data represents batch water inputs specific to each mix design&lt;br&gt;• <strong>Time</strong>: very good&lt;br&gt;Data is within three years&lt;br&gt;• <strong>Geography</strong>: very good&lt;br&gt;• <strong>Completeness</strong>: very good&lt;br&gt;Primary data from current Argos mix sheets&lt;br&gt;• <strong>Reliability</strong>: very good&lt;br&gt;Data based on actual use</td>
</tr>
</tbody>
</table>
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<table>
<thead>
<tr>
<th>Process</th>
<th>LCI Data Source</th>
<th>Geography</th>
<th>Year</th>
<th>Data Quality Assessment</th>
</tr>
</thead>
</table>
| **Cement** | Portland cement, at plant (USLCI). Modified to include upstream impacts of fuel and energy production | US | 2007 | • **Technology**: good  
Process represents average cement production in the US  
• **Time**: fair  
Data is within 10 years  
• **Geography**: very good  
• **Completeness**: good  
Data is based on an average of national production  
• **Reliability**: good |
| **Fly Ash** | None, no incoming burden and only inbound transport was considered | N/A | N/A | N/A |
| **Plasticizing Admixture (Type A Water Reducer)** | EFCA 324 Plasticizing Eco-Profile | Europe | 2006 | • **Technology**: very good  
Process represents admixture production for use in concrete  
• **Time**: fair  
Data is within ten years  
• **Geography**: fair  
• **Completeness**: good  
Data from a federation of European admixture producers  
• **Reliability**: fair  
EPD is not compliant with ISO standards. |
| **Sand** | Sand (GLO), market for (ecoinvent 3) | Global | 2011 | • **Technology**: very good  
Process represents extraction of sand for production  
• **Time**: very good  
Data from year of study  
• **Geography**: fair  
• **Completeness**: good  
Data is representative of global production  
• **Reliability**: good  
ecoinvent has verified the data |

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<table>
<thead>
<tr>
<th>Process</th>
<th>LCI Data Source</th>
<th>Geography</th>
<th>Year</th>
<th>Data Quality Assessment</th>
</tr>
</thead>
</table>
| Super-plasticizing Admixture       | EFCA 325 Super-Plasticizing Eco-Profile   | Europe    | 2006 | • **Technology:** very good  
Process represents admixture production for use in concrete  
• **Time:** fair  
Data is within ten years  
• **Geography:** fair  
• **Completeness:** good  
Data from a federation of European admixture producers  
• **Reliability:** fair  
EPD is not compliant with ISO standards |
| Electricity                        | Electricity, medium voltage (PA), market for (modified from ecoinvent 3) | Panama    | 2008 | • **Technology:** good  
Process represents energy mix of Panama electricity  
• **Time:** fair  
Data is within ten years  
• **Geography:** fair  
• **Completeness:** good  
Data is representative of Panama production  
• **Reliability:** good |
| Wash Water                         | LCI of Portland Cement Concrete          | US        | 2006 | • **Technology:** good  
Process uses averages for different plant types and regional areas  
• **Time:** fair  
Data is within ten years  
• **Geography:** fair  
Data is for production in the United States  
• **Completeness:** very good  
Data from Portland Cement Associations annual surveys  
• **Reliability:** good  
Data base on surveys |
### Environmental Product Declaration (EPD) for Concrete

<table>
<thead>
<tr>
<th>Process</th>
<th>LCI Data Source</th>
<th>Geography</th>
<th>Year</th>
<th>Data Quality Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Truck Transportation</td>
<td>Transport, combination truck, diesel powered (USLCI)</td>
<td>US</td>
<td>2008</td>
<td></td>
</tr>
</tbody>
</table>

- **Technology**: very good
  - Process represents combustion of diesel for transportation
- **Time**: fair
  - Data is within ten years
- **Geography**: fair
- **Completeness**: good
  - Data is representative of US conditions
- **Reliability**: good
  - Data is from USLCI database

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**ARGOS**

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### Environmental Impacts

This EPD covers the required set of environmental impact categories and metrics in accordance with the PCR, Section 3.2 (CLF 2013), given in the table below:

<table>
<thead>
<tr>
<th>Inventory / Impact Metrics</th>
<th>Unit</th>
<th>Abbreviation</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Inventory Metric</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total primary energy consumption</td>
<td>MJ</td>
<td>TED</td>
<td>Inventory Metric</td>
</tr>
<tr>
<td>Concrete batching water consumption</td>
<td>m³</td>
<td>BW</td>
<td>Inventory Metric</td>
</tr>
<tr>
<td>Concrete washing water consumption</td>
<td>m³</td>
<td>WW</td>
<td>Inventory Metric</td>
</tr>
<tr>
<td>Total water consumption</td>
<td>m³</td>
<td>TW</td>
<td>Inventory Metric</td>
</tr>
<tr>
<td>Depletion of non-renewable energy resources</td>
<td>MJ</td>
<td>NRED</td>
<td>Inventory Metric</td>
</tr>
<tr>
<td>Depletion of non-renewable material resources</td>
<td>kg</td>
<td>NRMR</td>
<td>Inventory Metric</td>
</tr>
<tr>
<td>Use of renewable material resources</td>
<td>kg</td>
<td>RMR</td>
<td>Inventory Metric</td>
</tr>
<tr>
<td>Use of renewable primary energy</td>
<td>MJ</td>
<td>RED</td>
<td>Inventory Metric</td>
</tr>
<tr>
<td>Hazardous waste</td>
<td>kg</td>
<td>HW</td>
<td>Inventory Metric</td>
</tr>
<tr>
<td>Non-hazardous waste</td>
<td>kg</td>
<td>NHW</td>
<td>Inventory Metric</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Impact Assessment Metrics</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Climate change</td>
<td>kg CO₂ eq</td>
<td>GWP</td>
<td>TRACI 2.1</td>
</tr>
<tr>
<td>Ozone depletion</td>
<td>kg CFC-11 eq</td>
<td>OD</td>
<td>TRACI 2.1</td>
</tr>
<tr>
<td>Acidification</td>
<td>kg SO₂ eq</td>
<td>AP</td>
<td>TRACI 2.1</td>
</tr>
<tr>
<td>Eutrophication</td>
<td>kg N eq</td>
<td>EP</td>
<td>TRACI 2.1</td>
</tr>
<tr>
<td>Photochemical ozone creation/Smog</td>
<td>kg O₃ eq</td>
<td>SMOG</td>
<td>TRACI 2.1</td>
</tr>
</tbody>
</table>

This EPD does not cover any optional additional information specified in the PCR Section 3.2.
## LCA
**Miraflores**

<table>
<thead>
<tr>
<th>Results Categories</th>
<th>Unit</th>
<th>Mix Code 10014375 (4000 psi)</th>
<th>Mix Code 10019170 (8000 psi)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Inventory Metric</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total primary energy consumption</td>
<td>MJ</td>
<td>2646</td>
<td>3678</td>
</tr>
<tr>
<td>Concrete batching water consumption</td>
<td>m³</td>
<td>0.161</td>
<td>0.104</td>
</tr>
<tr>
<td>Concrete washing water consumption</td>
<td>m³</td>
<td>0.061</td>
<td>0.064</td>
</tr>
<tr>
<td>Total water consumption</td>
<td>m³</td>
<td>21</td>
<td>17.4</td>
</tr>
<tr>
<td>Depletion of non-renewable energy resources</td>
<td>MJ</td>
<td>2612</td>
<td>3628</td>
</tr>
<tr>
<td>Depletion of non-renewable material resources</td>
<td>kg</td>
<td>2448</td>
<td>2494</td>
</tr>
<tr>
<td>Use of renewable material resources</td>
<td>kg</td>
<td>0.764</td>
<td>1.030</td>
</tr>
<tr>
<td>Use of renewable primary energy</td>
<td>MJ</td>
<td>33.9</td>
<td>50.4</td>
</tr>
<tr>
<td>Hazardous waste</td>
<td>kg</td>
<td>3.36E-04</td>
<td>1.05E-01</td>
</tr>
<tr>
<td>Non-hazardous waste</td>
<td>kg</td>
<td>0.731</td>
<td>0.726</td>
</tr>
<tr>
<td><strong>Impact Assessment Metrics</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Climate change</td>
<td>kg CO₂ eq</td>
<td>432</td>
<td>633</td>
</tr>
<tr>
<td>Ozone depletion</td>
<td>kg CFC-11 eq</td>
<td>5.61E-06</td>
<td>8.27E-06</td>
</tr>
<tr>
<td>Acidification</td>
<td>kg SO₂ eq</td>
<td>2.29</td>
<td>3.34</td>
</tr>
<tr>
<td>Eutrophication</td>
<td>kg N eq</td>
<td>0.068</td>
<td>0.094</td>
</tr>
<tr>
<td>Photochemical ozone creation/Smog</td>
<td>kg O₃ eq</td>
<td>32.9</td>
<td>45.8</td>
</tr>
</tbody>
</table>

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References

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