Environmental Product Declaration for Concrete
Declared Unit: 1 m$^3$ of 24 MPa concrete (3,500 psi)

**LIFE CYCLE INVENTORY DATA**

<table>
<thead>
<tr>
<th>Product ID</th>
<th>10K11521</th>
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<tbody>
<tr>
<td>Total primary energy consumption (MJ)</td>
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<tr>
<td>Concrete batching water consumption (m$^3$)</td>
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<td>Concrete washing water consumption (m$^3$)</td>
<td>6.54E-03</td>
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<td>Total water consumption (m$^3$)</td>
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<tr>
<td>Use of renewable primary energy (MJ)</td>
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<td>Depletion of non-renewable energy resources (MJ)</td>
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<tr>
<td>Use of renewable material resources (kg)</td>
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<tr>
<td>Depletion of non-renewable material resources (kg)</td>
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<td>Hazardous waste (kg)</td>
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<td>Non-hazardous waste (kg)</td>
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**LIFE CYCLE IMPACT ASSESSMENT**

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<tr>
<td>Climate change* (kg CO$_2$ eq)</td>
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<td>Ozone depletion* (kg CFC 11 eq)</td>
<td>8.30E-09</td>
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<td>Acidification** (kg SO$_2$ eq)</td>
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<td>Eutrophication** (kg N eq)</td>
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<td>Photochemical Ozone Creation/smog** (kg O$_3$ eq)</td>
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</table>

* CML based characterization  **TRACI based characterization

About Redi-Mix Concrete
Redi-Mix's comprehensive technical expertise, combined with patented, branded products and industry leadership in environmental stewardship and commitment to green building accomplishment, achieves industry wide recognition and acknowledgement. Redi-Mix is an integral member of the U.S. Concrete group and the leading ready-mix concrete supplier in the DFW and North Texas markets over the past 30 years. Our mission is to provide an unparalleled level of excellence in the supply of high quality, premium concrete products and services to the commercial, residential, civil / heavy highway and public works sectors.
### ENVIRONMENTAL PRODUCT DECLARATION VERIFICATION

#### EPD Information

<table>
<thead>
<tr>
<th>Program Operator</th>
<th>Declaration Holder</th>
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<tr>
<td>NSF International</td>
<td>Redi-Mix Concrete, LLC</td>
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<table>
<thead>
<tr>
<th>Product</th>
<th>Date of Issue</th>
<th>Period of Validity</th>
<th>Declaration Number</th>
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<td>10K11521</td>
<td>August 15, 2014</td>
<td>5 Years</td>
<td>EPD10071</td>
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</table>

This EPD was independently verified by NSF International in accordance with ISO 14025:

☐ Internal  ☒ External

Tom Bruursema
Bruursema@nsf.org

This life cycle assessment was independently verified by in accordance with ISO 14044 and the reference PCR:

Jack Geibig
jgeibig@ecoform.com

#### LCA Information

<table>
<thead>
<tr>
<th>Basis LCA</th>
<th>LCA Preparer</th>
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<tr>
<td>Life Cycle Assessment Manager for Concrete Environmental Product Declaration July 2014</td>
<td>David Green BASF <a href="mailto:david.r.green@basf.com">david.r.green@basf.com</a></td>
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This life cycle assessment was critically reviewed in accordance with ISO 14044 by:

Bill Stough Sustainable Reasearch Group bstough@sustainableresearchgroup.com

#### PCR Information

<table>
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<th>Program Operator</th>
<th>Reference PCR</th>
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<td>Carbon Leadership Forum</td>
<td>Product Category Rules (PCR) for ISO 14025 Type III Environmental Product Declarations (EPDs) Concrete Version 1.1</td>
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</tbody>
</table>

Date of Issue: December 4, 2013

PCR review was conducted by:

Nick Santero PE International
ENVIRONMENTAL PRODUCT DECLARATION: DETAILED VERSION

Product Description

Products covered by this Environmental Product Declaration (EPD) are for general purpose concrete for commercial construction developed and produced by Redi-Mix Concrete for the Dallas, Texas market from Plant 259. The specified compressive strength is 3,500 psi at 28 days with a 5" specified slump and 1.5% design air. This mix has the following designated environmental exposure classes per ACI 318 – F0, S0, C0, P0..

This EPD reports the impacts for the product concrete further defined by ASTM C94, UNSPSC code 30111500 and CSI Specification Section 03 30 00. The life cycle phases covered are A1 (Raw Material Supply: Upstream Processes), A2 (Transportation from Supplier to Gate of Producer) and A3 (Manufacturing – Core Process). This EPD is based on a cradle-to-gate system boundary deemed appropriate as concrete mixtures are supplied to a variety of different products and the function of the final product is not specifically determined. Life cycle stages that are not included in this EPD are A4 (Transportation to the Construction Site), A5 (Construction and Installation Process), B1-7 (Use Phase) and C1-4 (End of Life Stage).

Product Components

The product components for the mixes identified for this EPD meet the following ASTM Standards:

<table>
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<tr>
<th>Component</th>
<th>Standard</th>
<th>Specification for:</th>
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<tr>
<td>Portland Cement</td>
<td>ASTM C150</td>
<td>Portland 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>
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<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>
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</tbody>
</table>

Declared Unit

The declared unit is 1 m³ of Redi-Mix Concrete, LLC brand concrete produced for commercial construction with a specified compressive strength of 3,500 psi (24 MPa) at 28 days.

Cut-off Criteria
The cut-off criteria for raw material/energy consumption and environmental impacts for inclusion is less than 1% however for the Carbon Leadership Forum PCR all inputs and outputs for which data is available shall be included. The total of the estimated neglected input flows does not exceed 5% for the total impacts from energy, mass or climate change.

**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 energy used to store, batch, mix and distribute the concrete and operate the facility (concrete plant).

A summary of processes *excluded* from the EPD is as follows:

1. Production, manufacture 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.

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 and habitat destruction.
2. This EPD reports the results of an LCA for ‘cradle-to-gate’ analysis. Thus, declarations themselves 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. Life Cycle Impact Assessment results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks.
5. 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.
EPDs of concrete mixtures 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.

**Data Quality and Variability**

This EPD was created using industry average data for upstream materials. Variation can result from differences in supplier locations, manufacturing processes, manufacturing efficiency and fuel type used. A range of climate change impacts is not available at this time due to a lack of industry average data. The EPD will be updated as industry average data becomes available for any/all inputs. The data sources used in the life-cycle assessment are included in Table 1. An assessment of the data quality selected for this EPD was conducted using the five data quality indicators per the “Greenhouse Gas Protocol Product Life Cycle Accounting and Reporting Standard”. A summary of the assessment is shown in Table 2 with data quality rated from low to high in the categories of “Technological Representativeness”, “Geographical Representativeness”, “Temporal Representativeness”, “Completeness” and “Reliability”.

<table>
<thead>
<tr>
<th>Eco-Profile</th>
<th>Year</th>
<th>Source/Region</th>
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<tbody>
<tr>
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<td>Ground Granulated Blast Furnace Slag</td>
<td>2012</td>
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<tr>
<td>Granite Powder</td>
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<td>Color</td>
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Table 1: Data Sources
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Table 2: Data Quality Assessment
References

1. North American Product Category Rules (PCR) for ISO 14025 Type III Environmental Product
   Declarations (EPDs) version 1.1.
3. Shonnard, D.; Kicherer, A; and Saling, P. Industrial Applications Using BASF Eco-Efficiency Analysis:
   assessment of product systems -- Principles, requirements and guidelines; ISO 14045. ISO, Geneva,