Environmental Product Declaration

Redi-Mix Concrete, LLC
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Environmental Product Declaration for Concrete

Declared Unit: 1 m^3 of 24 MPa concrete (3,500 psi)

LIFE CYCLE INVENTORY DATA	*Product ID* ***10K11521***
Total primary energy consumption (MJ)	**4,294**
Concrete batching water consumption (m^3)	**1.49E-01**
Concrete washing water consumption (m^3)	**6.54E-03**
Total water consumption (m^3)	**1.55E-01**
Use of renewable primary energy (MJ)	**59**
Depletion of non-renewable energy resources (MJ)	**4,236**
Use of renewable material resources (kg)	**0.51**
Depletion of non-renewable material resources (kg)	**0.01**
Hazardous waste (kg)	**0.0**
Non-hazardous waste (kg)	**108.4**

LIFE CYCLE IMPACT ASSESSMENT

Climate change* (kg CO_2 eq)	**343**
Ozone depletion* (kg CFC 11 eq)	**8.30E-09**
Acidification (kg SO_2 eq)**	**2.3**
Eutrophication (kg N eq)**	**5.9**
Photochemical Ozone Creation/smog (kg O_3 eq)**	**2.3**

* CML based characterization **TRACI based characterization

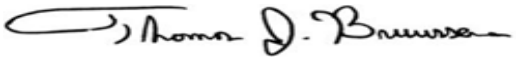
REDI-MIX CONCRETE
a US CONCRETE company

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.

SUSTAINABILITY CERTIFIED NSF Environmental Product Declaration

ENVIRONMENTAL PRODUCT DECLARATION VERIFICATION

EPD Information			
Program Operator		NSF International	
Declaration Holder		Redi-Mix Concrete, LLC	
Product 10K11521	Date of Issue August 15, 2014	Period of Validity 5 Years	Declaration Number EPD10071
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			
Basis LCA		Life Cycle Assessment Manager for Concrete Environmental Product Declaration July 2014	
LCA Preparer		David Green BASF david.r.green@basf.com	
This life cycle assessment was critically reviewed in accordance with ISO 14044 by:		Bill Stough Sustainable Reasearch Group bstough@sustainableresearchgroup.com	
PCR Information			
Program Operator		Carbon Leadership Forum	
Reference PCR		Product Category Rules (PCR) for ISO 14025 Type III Environmental Product Declarations (EPDs) Concrete Version 1.1	
Date of Issue		December 4, 2013	
PCR review was conducted by:		Nick Santero PE International	

Environmental Product Declaration

Redi-Mix Concrete, LLC 10K11521

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:

Component	*Standard*	*Specification for:*
Portland Cement	ASTM C150	Portland Cement
Fly Ash	ASTM C618	Coal fly ash and raw or calcined Natural pozzolan for use in concrete
Slag Cement	ASTM C989	Slag cement for use in concrete and mortars
Natural and Crushed Aggregates	ASTM C33	Concrete aggregates
Admixtures	ASTM C494	Chemical Admixtures for Concrete
Batch Water	ASTM C1602	Mixing water used in the production of hydraulic cement concrete

Declared Unit

The declared unit is 1 m^3 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

EPD Program Operator
NSF International
789 N. Dixboro Rd.
Ann Arbor MI 48105 USA
www.nsf.org

Date of Issue: August 15, 2014
Period of Validity: 5 years
Declaration#: EPD10071

NSF Sustainability℠
Sustainability Assured

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).
4. Water use in mixing and distributing concrete.

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 threshholds, safey 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 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".

Eco-Profile	*Year*	*Source/Region*
Cement	2010	BEST database[5]/U.S.
Fly Ash	2009	BEST database[5]/U.S.
Ground Granulated Blast Furnace Slag	2012	BEST database[5]/U.S.
Granite Powder	2012	BEST database[5]/U.S.
Limestone Powder	2013	BEST database[5]/U.S.
Silica Fume	2013	BEST database[5]/U.S.
Rice Husk Ash	2009	BEST database[5]/U.S.
Metakaolin	2008	BEST database[5]/U.S.
Fine Aggregate	2012	BEST database[5]/U.S.
Course Aggregate	2012	BEST database[5]/U.S.
Recycled Aggregate	2011	BEST database[5]/U.S.
Crushed Recycled Concrete	2012	BEST database[5]/U.S.
Water	2012	BEST database[5]/U.S.
Water Reducer	2012	BEST database[5]/U.S.
Mid-range Water Reducer	2012	BEST database[5]/U.S.
High Range Water Reducer	2012	BEST database[5]/U.S.
Accelerator	2012	BEST database[5]/U.S.
Retarder	2008	BEST database[5]/U.S.
Stabilizer	2012	BEST database[5]/U.S.
Corrosion Inhibitor	2012	BEST database[5]/U.S.
Air Entrainer	2012	BEST database[5]/U.S.
Color	2010	BEST database[5]/U.S.
Transportation - Truck	2010	BEST database[5]/U.S.
Transportation - Rail	2010	BEST database[5]/U.S.
Transportation - Ocean	2012	BEST database[5]/U.S.
Electricity – U.S	2013	BEST database[5]/U.S.

Table 1: Data Sources

Profile	*Technology*	*Temporal*	*Geography*	*Completeness*	*Reliability*
Cement	High	Medium-High	Medium-High	Medium-High	Medium-High
Fly Ash	Medium-High	Medium-High	Medium-High	Medium	Medium
Ground Granulated Blast Furnace Slag	Medium-High	High	Medium-High	Medium	Medium
Granite Powder	Medium-High	High	Medium-High	Medium	Medium
Limestone Powder	Medium-High	High	Medium-High	Medium	Medium
Silica Fume	Medium	High	Medium-High	Medium	Medium
Rice Husk Ash	Medium-High	Medium-High	Medium-High	Medium	Medium
Metakaolin	High	Medium-High	Medium-High	High	Medium-High
Fine Aggregate	Medium-High	High	Medium-High	Medium-High	Medium-High
Course Aggregate	Medium-High	High	Medium-High	Medium-High	Medium-High
Recycled Aggregate	Medium	Low	Medium-High	Medium	Low
Crushed Recycled Concrete	Medium	Low	Medium-High	Medium	Low
Water	Medium-High	High	Medium-High	High	Medium-High
Water Reducer	High	High	Medium-High	High	Medium-High
Mid-range Water Reducer	High	High	Medium-High	High	Medium-High
High Range Water Reducer	High	Medium-High	Medium-High	High	Medium-High
Accelerator	High	High	Medium-High	High	Medium-High
Retarder	High	High	Medium-High	High	Medium-High
Stabilizer	High	High	Medium-High	High	Medium-High
Corrosion Inhibitor	High	Medium-High	Medium-High	High	Medium-High
Air Entrainer	High	Medium-High	Medium-High	High	Medium-High
Color	High	Medium-High	Medium-High	High	Medium-High
Transportation - Truck	Medium-High	High	Medium-High	Medium-High	Medium-High
Transportation - Rail	Medium-High	Medium-High	Medium-High	Medium-High	Medium-High
Transportation - Ocean	Medium-High	Medium-High	Medium-High	Medium-High	Medium-High
Electricity – U.S	Medium-High	High	Medium-High	High	Medium-High

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.
2. Saling, P., A. Kicherer, B. Dittrich-Kraemer, R. Wittlinger, W. Zombik, I. Schmidt, W. Schrott, and S. Schmidt. 2002. Eco-efficiency Analysis by BASF: The Method. Int. J. Life Cycle Assess., 7 (4): 203.
3. Shonnard, D.; Kicherer, A; and Saling, P. Industrial Applications Using BASF Eco-Efficiency Analysis: Perspectives on Green Engineering Principles. Environ. Sci. Technol. 2003, 37, 5340-5348.
4. ISO, International Organization for Standardization. Environmental Management-Life Cycle Assessment-Principles and Framework; ISO 14040:2006; ISO 14044:2006. ISO, Geneva, Switzerland, www.iso.org (2006)
5. ISO, International Organization for Standardization. Environmental Management- Eco-efficiency assessment of product systems -- Principles, requirements and guidelines; ISO 14045. ISO, Geneva, Switzerland, www.iso.org (2012)
6. Boustead Consulting Ltd UK, The Boustead Model 5.1.2600.2180 LCA database.