Environmental Product Declaration

For Concrete

This Environmental Product Declaration (EPD) covers 30 concrete mixes produced by 1 concrete plant owned and operated by GCC in Tulsa, Oklahoma.

Corporate Headquarters
Cherry Creek Plaza 1
600 S. Cherry Street, 10th Floor
Glendale, CO 80246
303-739-5900

Tulsa, Oklahoma Plant
431 West 23rd St.
Tulsa, OK 74107
918-582-8111

NRMCA® CERTIFIED EPD

GCC - Tulsa, Oklahoma Plant
Ready-Mixed Concrete

According to ISO 14025

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 30 concrete mixes produced for 1 concrete plant owned and operated by GCC in Tulsa, Oklahoma.	
Declaration Owner:	**GCC Corporate Headquarters** Cherry Creek Plaza 1 600 S. Cherry Street, 10th Floor Glendale, CO 80246 303-739-5900 **www.gccusa.com**	
Program Operator:	**National Ready Mix Concrete Association** 900 Spring St. Silver Spring, MD 20910 301-587-1400 www.nrmca.org/sustainability Lionel Lemay	
LCA and EPD Developer:	**Athena Sustainable Materials Institute** 119 Ross Ave. #100 Ottawa, ON K1Y 0N6 613-729-9996 www.athenasmi.org James Salazar	
Independent LCA Reviewer:	**PRé North America Inc.** **202-728-5087** **www.pre-sustainability.com** J. Renee Morin	
Independent EPD Verifier:	**NSF International** **734-769-8010** **www.nsf.org** Jenny Oorbeck	
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: ASTM C94, ASTM C90, CSA A23.1/A23.2, UNSPSC code 30111500, Version 1.1 dated December 4, 2013, The Carbon Leadership Forum www.carbonleadershipforum.org.	
Date of Issue:	Issued September 30, 2015.	
Period of Validity:	5 Years (until September 30, 2020)	
EPD Number	NRMCAEPD:10007	

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Description of Company

Grupo Cementos de Chihuahua (GCC) is a high quality cement, concrete, and coal manufacturer. GCC first began operations in Mexico in 1941 and has since expanded business to the United States (U.S). In 1994, GCC formed the U.S. division with the purchase of a cement manufacturing plant in New Mexico. That same year, GCC grew to include a number of cement distribution terminals. In the 2000's, GCC increased cement manufacturing capacity by purchasing a cement plant in South Dakota and commissioning a plant in Colorado.

Over the past several years, GCC has continued to grow through numerous acquisitions including a coal mine in Colorado, Consolidated Ready Mix in South Dakota and Minnesota, Alliance Concrete in Iowa, Mid-Continent Concrete in Oklahoma and Arkansas, and a number of other ready mix concrete and transport operations.

The GCC-Tulsa Plant was acquired in 2006 and is part of the GCC Ready Mix Division. GCC-Tulsa proudly serves the Tulsa, Oklahoma metropolitan market with an average annual production volume of over 100,000 cubic yards of concrete.

At GCC, our passion for excellence is shared. Our mission is to be the supplier of choice in cement, concrete products and innovative solutions. GCC continues to accomplish this through the design, manufacture, and distribution of quality products in a manner which is protective of the health and safety of our employees, our customers, the public, and the environment.

Description of Product

Products covered by this EPD satisfy general purpose concrete as used in residential, commercial and public works applications in the US and Canada. This EPD reports the impacts for 30 different ready-mixed concrete products (listed in Table 1 on the following page) in accordance with the following:

- ACI 211: Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
- ACI 318: Building Code Requirements for Structural Concrete
- ASTM C94: Standard Specification for Ready-Mixed Concrete
- CSI MasterFormat Division 03-30-00: Cast-in-Place Concrete
- UNSPSC Code 30111500: Ready Mix Concrete

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Table 1. Declared Product Range Classification

Product ID	Product Code	Mix Properties				
		28 day CS (PSI)	Water cement ratio (%)	Fly Ash (%)	Slag (%)	Air Entrained
1000308	SUB,00,FF,8,6,T1A50,400	300	1.11	0	0	N
1030025	SUB,30,REG,LS,5,2,T1A25,440	3000	0.63	25	0	N
1030026	SUB,30,REG,LS,5,5.5,T1A25,440	3000	0.57	25	0	Y
1035020	SUB,35,REG,LS,5,2,T1A20,470	3500	0.55	20	0	N
1035021	SUB,35,REG,LS,5,6,T1A20,470	3500	0.53	20	0	Y
1035025	SUB,35,REG,LS,5,2,T1A25,470	3500	0.53	25	0	N
1035026	SUB,35,REG,LS,5,5.5,T1A25,470	3500	0.53	25	0	Y
1040000	SUB,40,REG,LS,5,2,T1,520	4000	0.51	0	0	N
1040020	SUB,40,REG,LS,5,2,T1A20,520	4000	0.5	20	0	N
1040021	SUB,40,REG,LS,5,5.5,T1A20,520	4000	0.48	20	0	Y
1040025	SUB,40,REG,LS,5,2,T1A25,520	4000	0.48	25	0	N
1040026	SUB,40,REG,LS5,5.5,T1A25,520	4000	0.48	25	0	Y
1040830	SUB,40,PRP,LS,7,2,T1A30,600	4000	0.49	30	0	N
1403004	DOT,35,REG,2,6,T1,520,CLASS A	4000	0.47	0	0	Y
1403005	DOT,35,REG,2,6,T1A20,517,CLASS A	4000	0.45	20	0	Y
1045020	SUB,45,REG,LS,5,2,TA20,565	4500	0.45	20	0	N
1045021	SUB,45,REG,LS,5,6,TA20,565	4500	0.44	20	0	Y
1045025	SUB,45,REG,LS,5,2,T1A25,565	4500	0.45	25	0	N
1045026	SUB,45,REG,LS,5,5.5,T1A25,565	4500	0.44	25	0	Y
1045500	SUB,45,REG,LS,5,2,T1,570	4500	0.45	0	0	N
1045620	SUB,45,REG,LS,5,2,T1A20,565,AG6	4500	0.45	20	0	N
1045625	SUB,45,REG,LS,5,2,T1A25,565,AG6	4500	0.45	25	0	N
1404077	DOT,CLASS AA	4500	0.44	0	0	Y
1050000	SUB,50,REG,LS,5,2,T1,615	5000	0.43	0	0	N
1050001	SUB,50,REG,LS,5,5,T1,615	5000	0.42	0	0	Y
1050020	SUB,50,REG,LS,5,2,T1A20,615	5000	0.42	20	0	N
1050021	SUB,50,REG,LS,5,5,T1A20,615	5000	0.41	20	0	Y
1055020	SUB,55,REG,LS,5,2,T1A20,660	5500	0.39	20	0	N
1055021	SUB,55,REG,LS,5,6,T1A20,660	5500	0.38	20	0	Y
1060020	SUB,60,REG,LS,5,2,T1A20,725	6000	0.37	20	0	N

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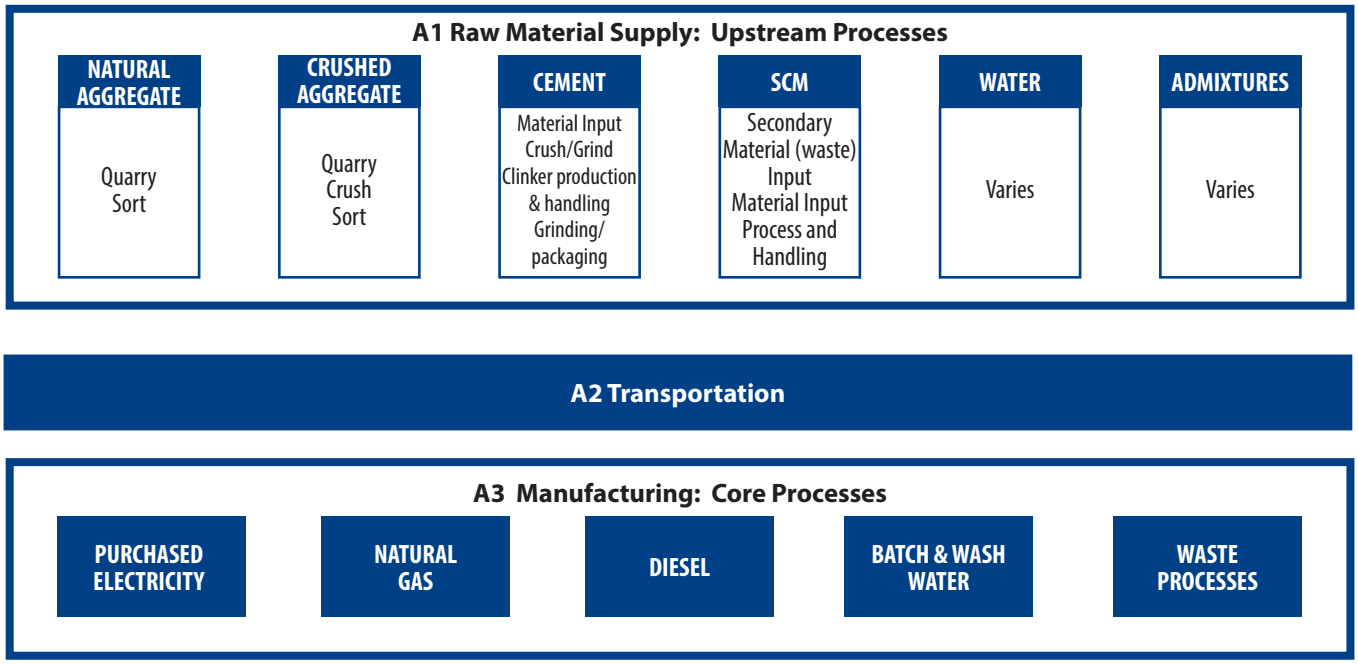
Cradle-to-Gate Life Cycle of Concrete

Business-to-Business EPD and Cradle-to-Gate LCA

This EPD is intended for use in Business to Business (B-to-B) communication. The scope of this EPD is cradle-to-gate and considers the following life cycle stages.

- **A1 - Raw Material Supply:** Includes all upstream processes related to extraction, handling, and processing of the raw materials and intermediate component products as well as fuels used in the production of concrete. Component products include cement, supplementary cementitious materials, aggregate (coarse and fine), water, admixtures and other materials or chemicals used in concrete mixtures.
- **A2 - Transportation:** Accounts for the transportation of all input materials and fuels from the supplier to the gate of the concrete plant.
- **A3 - Manufacturing (Core Processes):** Includes all core processes and the energy and water used to store, move, batch and mix the concrete and operate the concrete plant as well as the transportation and processing of wastes from these core processes.

Figure 1: Cradle-to-gate product system for concrete



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Methodology of Underlying LCA

Declared Unit

The declared units are 1 cubic meter and 1 cubic yard for 30 ready mixed concrete products. Key product variables include:

- **28-day Strength**: Eight different specified compressive strengths are represented in the 30 mix designs: 300 psi (2.7 MPa); 3,000 psi (20.7 MPa); 3,500 psi (24.1 MPa); 4,000 psi (27.6 MPa); 4,500 psi (31.0 MPa); 5,000 psi (34.5 MPa); 5,500 psi (37.9 MPa); and 6,000 psi (41.3 MPa);
- **Water to cementious materials ratio (w/cm):** as per mix design specification provided by GCC in accordance with ACI 211.1;
- **SCM reactivity:** as per mix design specification provided by GCC in accordance with ACI 211.1;
- **Admixtures use:** Admixture use was specified for the different mixes that were modeled. These admixtures included an air-entraining admixture, water reducing and accelerating admixtures, and high range water reducer admixtures.

Product (mix design) components include: portland cement, fly ash, natural and crushed aggregates, admixtures and batch water.

Scope of LCA

The life cycle stages included in this EPD are limited to raw materials and component products used in the manufacture of ready-mixed concrete (A1), the transportation of these materials and components to the concrete plant (A2), and the manufacture of ready-mixed concrete (A3) ready for shipment at the plant gate.

Life cycle stages excluded from this EPD include:

- Transport to the construction site;
- On-site construction processes and components (reinforcement, forms and form work, placing and curing);
- Building (infrastructure) use and maintenance; and
- End of life effects.

In addition, the following life cycle processes are excluded from this study:

- Production, manufacture and construction of buildings' capital goods and infrastructure;
- Production and manufacture of concrete production and mobile equipment;
- Personnel-related activities (commuting, furniture, office supplies); and
- Energy and hygiene water use related to facility management activities.

Note: GCC's Tulsa Oklahoma plant is a truck-mixing plant where the concrete mixing occurs within mixer trucks after they are loaded and at the project site; for these operations, a portion of the delivery truck's energy use that would typically be captured under "Construction and Process Stage" ***A4-Transportation*** (to site) is allocated to the mixing of concrete for truck-mixing plants and is captured in information module A3. This system boundary refinement addresses the difference between truck-mixing and central-mixing concrete plants where the latter plant type fully mixes the concrete prior to loading the concrete into delivery trucks.

Cut-off Rules

The cut-off criteria for all activity stage flows considered within the system boundary conform with ISO14044:2006 and section 3.3 of the governing PCR. Specifically, the cut-off criteria were applied as follows:

- All inputs and outputs for which data are available are included in the calculated effects and no collected core process data are excluded.
- A one percent cut-off is considered for renewable and non-renewable primary energy consumption and the total mass of inputs within a unit process. The sum of the total neglected flows does not exceed 5% of all energy consumption and mass of inputs.
- All flows known to contribute a significant impact or to uncertainty (e.g., portland cement and admixtures) are included.
- The cut-off rules are not applied to hazardous and toxic material flows – all of which are included in the life cycle inventory.

Allocation

The applied allocation procedures conform with ISO14044 clause 4.3.4.

Limitations

The limitations of this EPD include:

- 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 LCA-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.
- In order to assess the local impacts of product manufacturing , additional analysis is required.
- This EPD reports the results of an LCA or the '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 perfroms 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.
- GCC may participate in other sustainability or environmental best practice programs. However, no such additional environmental claim or declaration is conveyed in this EPD.
- 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.
- Life cycle impact assessment (LCIA) results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks.

Data Sources and Data Quality Assessment

This EPD is based on foreground LCI data collected from GCC's Tulsa, Oklahoma production facility. All upstream material, resource and energy carrier inputs have been sourced from various industry-average datasets and literature. Many of these data sets are defaulted to those specified for use in the CLF PCR. Care was taken to fill known data gaps (dummies) as recorded in the USLCI database profiles. Tables 2 to 4 describe each LCI data source for raw materials (A1), transportation by mode (A2), the RMC core manufacture process (A3), and descriptions of data quality for each data source.

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.

Table 2: A1 - Raw Material Supply

Material/Unit	LCI data source [as per CLF PCR: 2013]	Geography	Year	Data Quality Assessment
Cement (lbs)	MIT 2014 paper, Update of portland cement, at plant (USLCI) modified to include upstream impacts of fuel and energy production. Electricity grid modeled as SPP region to reflect the sourcing of cement from suppliers from within the southwest region.	USA/Oklahoma	2010	• Technology: good Process represents average cement production in the U.S. and electricity production in the SPP region. • Time: very good Data is within 5 years • Geography: very good • Completeness: good Data is based on an average of regional production. • Reliability: very good
Fly Ash (lbs)	None, no incoming burden. Only inbound transport was considered.	N/A	N/A	N/A
Crushed Aggregates (lbs) coarse and fine	ecoinvent process: "Gravel, crushed, at mine" ecoinvent 2.02, CLF PCR Default	EU	2004	• Technology: good Processes represent aggregate, with and without crushing. Dust emissions are estimated from limestone mining. • Time: fair Data is within ten years. • Geography: fair Processes model Swiss production (no U.S. process in USLCI database). • Completeness: very good • Reliability: very good Data is verified by ecoinvent.
Admixtures (lbs) *Accelerator* *Air Entrainer* *Retarding* *Waterproofing* *Plasticizer* *Superplasticizer*	EFCA EcoProfiles (300, 301, 302, 303, 324 and 325) http://www.efca.info/publications.html	EU	2005 -2006	• Technology: very good Processes represents admixture production for use in concrete. • Time: fair Data is within ten years • Geography: fair • Completeness: good Data is from a federation of European admixture producers. • Reliability: good Profiles have undergone an independent review process. Compliance with ISO standards is unknown.

Table 2: A1 - Raw Material Supply Con't

Material/Unit	LCI data source [as per CLF PCR: 2013]	Geography	Year	Data Quality Assessment
Concrete Batch and Wash Water (gallons)	Primary (Pre-consumer, burden of crushing is reported and included in module A3)	Oklahoma	2013	• Technology: very good Primary data was collected via survey. • Time: very good Data is within two years • Geography: very good • Completeness: very good Primary data is from core processes survey. • Reliability: very good Data is based on specified use.
Oil, Lubricants and Greases (lbs)	ecoinvent 3.01, Lubricating oil {US}| production | Alloc Def, U	USA	2008	• Technology: good Process models the manufacture of lubricants. • Time: good Data is within ten years. • Geography: good Processes models US production • Completeness: very good • Reliability: very good Data is verified by ecoinvent.

Table 3: A2 - Transportation

Process	LCI Data Source	Geography	Year	Data Quality Assessment
Truck, rail, ocean freighter and barge (lbs*miles)	USLCI – single unit truck transport, diesel powered; rail transport, diesel powered; ocean freighter, average fuel mix; barge, average fuel mix	USA	2008	• Technology: very good Process represents U.S. average transportation profiles • Time: Fair Data is within 10 years • Geography: fair • Completeness good (all data place holders filled) • Reliability: good

Table 4: A3 - Manufacturing

Process	LCI Data Source	Geography	Year	Data Quality Assessment
Electricity (kWh)	ecoinvent 3.01, 2014 LCI datasets for: Electricity, medium voltage {SPP, US only}|	USA/Oklahoma	2008	• Technology: very good Process represents production of electricity in the appropriate NERC region. • Time: fair Data is within ten years. • Geography: very good • Completeness: good Data is representative of Oklahoma production. • Reliability: good Data has been verified by ecoinvent.
Natural Gas (cu. ft.)	USLCI	USA	2008	• Technology: very good Process represents combustion of natural gas in an industrial boiler. • Time: fair Data is within ten years. • Geography: fair • Completeness: good Data is representative of U.S. conditions. • Reliability: good Data is from USLCI database.
Diesel (gallon)	USLCI	USA	2008	• Technology: very good Process represents combustion of diesel in industrial equipment. • Time: fair Data is within ten years. • Geography: fair • Completeness: good Data is representative of U.S. conditions. • Reliability: good Data is from USLCI database.
Non-Hazardous Solid Waste (lbs)	ecoinvent 3.01; Adjusted for U.S. electricity grid	EU/USA	2008	• Technology: good • Time: fair Data is within ten years. • Geography: fair Processes model Swiss production (no U.S. process in USLCI database). • Completeness: very good • Reliability: very good Data is verified by ecoinvent.

Data Quality

Data quality/variability requirements, as specified in the CLF PCR: 2013 sections 3.5 and 3.6, are applied. This section describes the achieved data quality relative to the ISO 14044:2006 requirements. Data quality is judged on the basis of its precision (measured, calculated or estimated), completeness (e.g., unreported emissions), consistency (degree of uniformity of the methodology applied within a study serving as a data source) and representativeness (geographical, temporal, and technological).

Precision: Through measurement and calculation, the manufacturer collected and provided primary data on their annual production RMC products. For accuracy, the LCA team validated these plant gate-to-gate input and output data.

Completeness: All relevant specific processes, including inputs (raw materials, energy and ancillary materials) and outputs (emissions and production volume) were considered and modeled to represent the specified and declared RMC products. The relevant background materials and processes were taken from the US LCI Database (adjusted for known data placeholders)and US system boundary adjusted ecoinvent v 2.2 and v3.0 LCI databases were modeled in SimaPro software v.8.0.1, 2014.

Consistency: To ensure consistency, the LCI modeling of the production weighted input and output LCI data for the declared products used the same modeling structure across the respective product systems, which consisted of input raw and ancillary material, energy flows, water resource inputs, product and co-products outputs, returned and recovered concrete materials, emissions to air, water and soil, and waste recycling and treatment. The same background LCI datasets from the SimaPro LCI database were used across all RMC product systems. Crosschecks concerning the plausibility of mass and energy flows were continuously conducted. The LCA team conducted mass and energy balances at the plant and selected process level to maintain a high level of consistency.

Reproducibility: Internal reproducibility is possible since the data and the models are stored and available in a SimaPro database for all background processes, and in Athena's proprietary concrete LCA calculator* for all production facility and mix-specific calculations. A considerable level of transparency is provided throughout the LCA report as the specifications and material quantity make-up for the declared RMC products are presented and key primary and secondary LCI data sources are summarized. The provision of more detailed data to allow full external reproducibility was not possible due to reasons of confidentiality. ** Athena has developed a propietary excel-based tool that allows the calculation of PCR-compliant LCA results for ready-mixed concrete product mix designs. The tool scales results for base-unit technosphere inputs (i.e. 1lb portland cement, 1 kWh electricity, etc.) to replicate the reference flow conversions that take place in SimaPro. The tool was tested against the NRMCA average LCA results (Athena SMI, 2014) that were developed exclusviely in SimaPro and generated results within 1-2% in every impact category and inventory metric.*

Representativeness: The representativeness of the data is summarized as follows.

- Time related coverage of the manufacturing processes' primary collected data: 2013 (12 months).
- Upstream (background) LCI data was either the PCR specified default or more appropriate LCI datasets as found in the US LCI (adjusted) Database, US adjusted ecoinvent v.2.2 and v.3.0 database, 2014.
- Geographical coverage for the cement and RMC plant operations is Oklahoma; other upstream and background processes are based on North American average data.
- Technological coverage is typical or average – specific to GCC's Tulsa, Oklahoma facility for all primary data.

Life Cycle Assessment Results

Environmental Indicators and Inventory Metrics

Per the governing PCR, this EPD supports 15 life cycle impact assessment indicators and inventory metrics as listed in Table 5. Tables 6a and 6b report the LCA results for each product. Table 6a shows cubic meter results and Table 6b shows cubic yard results.

Table 5. Life Cycle Category Indicators and Inventory Metrics

#	LCIA Indicators	Abbreviations	Units
1	Global Warming Potential (climate change)	**GWP**	kg CO2-eq
2	Ozone Depletion Potential	**ODP**	kg CFC-11-eq
3	Acidification Potential	**AP**	kg SO2-eq
4	Eutrophication Potential	**EP**	kg N-eq
5	Photochemical Ozone Creation/Smog Potential	**POCP**	kg O3-eq
	Inventory Metrics		
6	Total primary energy consumption	**PEC**	MJ (HHV)
7	Depletion of non-renewable energy resources	**NRE**	MJ (HHV)
8	Use of renewable primary energy	**RE**	MJ (HHV)
9	Depletion of non-renewable material resources	**NRM**	kg
10	Use of renewable material resources	**RM**	kg
11	Concrete batching water consumption	**CBW**	m3
12	Concrete washing water consumption	**CWW**	m3
13	Total water consumption	**TW**	m3
14	Concrete hazardous waste	**CHW**	kg
15	Concrete non-hazardous waste	**CNHW**	kg

*HHV, higher heating value (also called gross calorific value) is the heat of combustion of a given amount of fuel that includes the calorific value of condensing the water content of the fuel (the heat of vaporization). The lower heating value (LHV) excludes the heat of vaporization of the water content and thus the HHV is equal to the LHV plus the heat of vaporization.

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Impact Assessment Results

Table 6a. Summary Results (A1-A3): GCC Tulsa Oklahoma Plant, per cubic meter

Indicator/LCI Metric		GWP	ODP	AP	EP	POCP	PEC	NRE	RE	NRM	RM	CBW	CWW	TW	CHW	CNHW
Product ID	28 day CS (PSI)	kg CO2	kg CFC-11	kg SO2	kg N	kg O3	MJ	MJ	MJ	kg	kg	m3	m3	m3	kg	kg
1000308	300	159.07	2.57E-6	0.76	0.10	11.10	1,308.22	1,303.12	5.10	1,850.32	0.22	0.27	0.12	0.38	0.00	2.95
1030025	3000	255.20	4.13E-6	1.16	0.16	15.56	2,055.05	2,045.42	9.64	2,343.46	0.42	0.16	0.12	0.27	0.00	2.95
1030026		254.40	4.10E-6	1.15	0.16	15.44	2,043.41	2,033.88	9.53	2,261.75	0.41	0.15	0.12	0.27	0.00	2.95
1035020	3500	284.18	4.54E-6	1.27	0.18	16.54	2,244.39	2,234.07	10.32	2,371.91	0.44	0.16	0.12	0.27	0.00	2.95
1035021		283.81	4.53E-6	1.26	0.18	16.47	2,239.14	2,228.85	10.30	2,290.20	0.44	0.15	0.12	0.27	0.00	2.95
1035025		269.46	4.33E-6	1.21	0.17	16.09	2,151.29	2,141.30	9.99	2,359.94	0.43	0.15	0.12	0.27	0.00	2.95
1035026		269.25	4.31E-6	1.21	0.17	15.98	2,143.21	2,133.31	9.90	2,266.55	0.42	0.15	0.12	0.27	0.00	2.95
1040000	4000	375.29	5.87E-6	1.61	0.23	19.64	2,843.72	2,831.05	12.67	2,472.06	0.51	0.16	0.12	0.28	0.00	2.95
1040020		310.00	4.91E-6	1.36	0.19	17.49	2,417.89	2,406.92	10.97	2,382.44	0.46	0.16	0.12	0.27	0.00	2.95
1040021		309.28	4.89E-6	1.36	0.19	17.38	2,407.43	2,396.55	10.88	2,294.45	0.45	0.15	0.12	0.27	0.00	2.95
1040025		293.70	4.67E-6	1.30	0.18	16.96	2,311.72	2,301.18	10.54	2,365.54	0.45	0.15	0.12	0.27	0.00	2.95
1040026		293.05	4.65E-6	1.30	0.18	16.85	2,302.36	2,291.89	10.47	2,271.26	0.44	0.15	0.12	0.27	0.00	2.95
1040830		308.17	4.81E-6	1.35	0.19	17.15	2,367.84	2,357.79	10.05	2,285.42	0.41	0.18	0.12	0.29	0.00	2.95
1403004		374.85	5.86E-6	1.61	0.23	19.56	2,837.63	2,825.01	12.62	2,396.63	0.51	0.15	0.12	0.26	0.00	2.95
1403005		308.43	4.88E-6	1.36	0.19	17.38	2,405.58	2,394.66	10.92	2,308.38	0.46	0.14	0.12	0.26	0.00	2.95
1045020	4500	333.10	5.23E-6	1.45	0.20	18.33	2,571.93	2,560.41	11.52	2,395.69	0.47	0.15	0.12	0.27	0.00	2.95
1045021		332.29	5.21E-6	1.45	0.20	18.20	2,560.26	2,548.83	11.43	2,288.84	0.47	0.15	0.12	0.27	0.00	2.95
1045025		316.13	4.98E-6	1.39	0.20	17.77	2,461.14	2,450.07	11.08	2,365.33	0.46	0.15	0.12	0.27	0.00	2.95
1045026		315.51	4.96E-6	1.38	0.19	17.66	2,452.20	2,441.19	11.01	2,274.19	0.46	0.15	0.12	0.27	0.00	2.95
1045500		407.17	6.33E-6	1.73	0.24	20.77	3,054.89	3,041.46	13.43	2,504.08	0.53	0.16	0.12	0.27	0.00	2.95
1045620		332.73	5.23E-6	1.45	0.20	18.29	2,566.48	2,555.03	11.45	2,395.69	0.47	0.15	0.12	0.27	0.00	2.95
1045625		314.97	4.96E-6	1.38	0.19	17.69	2,449.25	2,438.30	10.96	2,367.58	0.46	0.15	0.12	0.27	0.00	2.95
1404077		402.73	6.25E-6	1.71	0.24	20.53	3,021.01	3,007.74	13.27	2,401.30	0.52	0.15	0.12	0.27	0.00	2.95
1050000	5000	435.94	6.74E-6	1.84	0.26	21.79	3,246.26	3,232.10	14.15	2,503.35	0.55	0.16	0.12	0.28	0.00	2.95
1050001		435.31	6.72E-6	1.84	0.26	21.69	3,237.19	3,223.11	14.08	2,418.50	0.55	0.16	0.12	0.27	0.00	2.95
1050020		357.68	5.58E-6	1.55	0.22	19.23	2,737.64	2,725.49	12.15	2,391.87	0.49	0.16	0.12	0.27	0.00	2.95
1050021		360.33	5.61E-6	1.56	0.22	19.25	2,751.13	2,738.95	12.18	2,314.62	0.49	0.15	0.12	0.27	0.00	2.95
1055020	5500	383.30	5.95E-6	1.65	0.23	20.15	2,908.16	2,895.39	12.77	2,402.41	0.51	0.16	0.12	0.27	0.00	2.95
1055021		382.67	5.93E-6	1.64	0.23	20.04	2,899.44	2,886.75	12.69	2,308.13	0.50	0.15	0.12	0.27	0.00	2.95
1060020	6000	415.56	6.40E-6	1.77	0.25	21.33	3,125.23	3,111.67	13.56	2,403.00	0.53	0.16	0.12	0.28	0.00	2.95

GCC - Tulsa, Oklahoma Plant
Ready-Mixed Concrete

According to ISO 14025

Table 6b. Summary Results (A1-A3): GCC Tulsa Oklahoma Plant, per cubic yard

Indicator/LCI Metric		GWP	ODP	AP	EP	POCP	PEC	NRE	RE	NRM	RM	CBW	CWW	TW	CHW	CNHW
Product ID	28 day CS (PSI)	kg CO2	kg CFC-11	kg SO2	kg N	kg O3	MJ	MJ	MJ	kg	kg	m3	m3	m3	kg	kg
1000308	300	121.77	1.97E-6	0.58	0.08	8.49	1,001.51	997.60	3.91	1,416.51	0.17	0.20	0.09	0.29	0.00	2.26
1030025	3000	195.37	3.16E-6	0.88	0.13	11.91	1,573.24	1,565.87	7.38	1,794.03	0.32	0.12	0.09	0.21	0.00	2.26
1030026		194.76	3.14E-6	0.88	0.12	11.82	1,564.33	1,557.03	7.30	1,731.48	0.32	0.12	0.09	0.20	0.00	2.26
1035020	3500	217.55	3.48E-6	0.97	0.14	12.67	1,718.19	1,710.29	7.90	1,815.81	0.34	0.12	0.09	0.21	0.00	2.26
1035021		217.27	3.47E-6	0.97	0.14	12.61	1,714.18	1,706.29	7.88	1,753.26	0.33	0.12	0.09	0.20	0.00	2.26
1035025		206.29	3.31E-6	0.93	0.13	12.32	1,646.91	1,639.27	7.65	1,806.65	0.33	0.12	0.09	0.20	0.00	2.26
1035026		206.13	3.30E-6	0.92	0.13	12.24	1,640.73	1,633.15	7.58	1,735.15	0.33	0.12	0.09	0.20	0.00	2.26
1040000	4000	287.30	4.50E-6	1.23	0.17	15.03	2,177.01	2,167.31	9.70	1,892.48	0.39	0.12	0.09	0.21	0.00	2.26
1040020		237.32	3.76E-6	1.04	0.15	13.39	1,851.01	1,842.62	8.40	1,823.88	0.35	0.12	0.09	0.21	0.00	2.26
1040021		236.77	3.74E-6	1.04	0.15	13.30	1,843.01	1,834.68	8.33	1,756.51	0.35	0.12	0.09	0.20	0.00	2.26
1040025		224.84	3.57E-6	1.00	0.14	12.98	1,769.74	1,761.67	8.07	1,810.94	0.34	0.12	0.09	0.20	0.00	2.26
1040026		224.34	3.56E-6	0.99	0.14	12.90	1,762.57	1,754.55	8.02	1,738.76	0.34	0.12	0.09	0.20	0.00	2.26
1040830		235.92	3.68E-6	1.03	0.14	13.13	1,812.70	1,805.01	7.69	1,749.60	0.31	0.14	0.09	0.22	0.00	2.26
1403004		286.97	4.48E-6	1.23	0.17	14.97	2,172.35	2,162.69	9.66	1,834.74	0.39	0.11	0.09	0.20	0.00	2.26
1403005		236.12	3.73E-6	1.04	0.15	13.31	1,841.59	1,833.23	8.36	1,767.18	0.35	0.11	0.09	0.20	0.00	2.26
1045020	4500	255.00	4.01E-6	1.11	0.16	14.03	1,968.94	1,960.12	8.82	1,834.02	0.36	0.12	0.09	0.21	0.00	2.26
1045021		254.38	3.99E-6	1.11	0.16	13.93	1,960.00	1,951.26	8.75	1,752.22	0.36	0.12	0.09	0.20	0.00	2.26
1045025		242.01	3.82E-6	1.06	0.15	13.60	1,884.13	1,875.64	8.48	1,810.78	0.35	0.12	0.09	0.21	0.00	2.26
1045026		241.54	3.80E-6	1.06	0.15	13.52	1,877.28	1,868.85	8.43	1,741.01	0.35	0.12	0.09	0.20	0.00	2.26
1045500		311.71	4.84E-6	1.33	0.19	15.90	2,338.67	2,328.39	10.28	1,916.99	0.41	0.12	0.09	0.21	0.00	2.26
1045620		254.72	4.00E-6	1.11	0.16	14.00	1,964.76	1,956.00	8.76	1,834.02	0.36	0.12	0.09	0.21	0.00	2.26
1045625		241.13	3.80E-6	1.06	0.15	13.54	1,875.02	1,866.64	8.39	1,812.50	0.35	0.12	0.09	0.21	0.00	2.26
1404077		308.31	4.79E-6	1.31	0.19	15.71	2,312.73	2,302.57	10.16	1,838.31	0.40	0.12	0.09	0.20	0.00	2.26
1050000	5000	333.74	5.16E-6	1.41	0.20	16.68	2,485.17	2,474.33	10.83	1,916.44	0.42	0.12	0.09	0.21	0.00	2.26
1050001		333.25	5.14E-6	1.41	0.20	16.60	2,478.22	2,467.45	10.78	1,851.48	0.42	0.12	0.09	0.21	0.00	2.26
1050020		273.82	4.27E-6	1.18	0.17	14.72	2,095.80	2,086.50	9.30	1,831.10	0.38	0.12	0.09	0.21	0.00	2.26
1050021		275.85	4.30E-6	1.19	0.17	14.74	2,106.12	2,096.80	9.33	1,771.96	0.38	0.12	0.09	0.20	0.00	2.26
1055020	5500	293.43	4.55E-6	1.26	0.18	15.43	2,226.34	2,216.56	9.78	1,839.16	0.39	0.12	0.09	0.21	0.00	2.26
1055021		292.95	4.54E-6	1.26	0.18	15.34	2,219.67	2,209.95	9.72	1,766.98	0.39	0.12	0.09	0.20	0.00	2.26
1060020	6000	318.13	4.90E-6	1.35	0.19	16.33	2,392.52	2,382.14	10.38	1,839.62	0.41	0.12	0.09	0.21	0.00	2.26

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