



Environmental Product Declaration of Average PPC and PSC Cement

ACC Limited

31 May 2018

ISO 14020:2000, ISO 14025:2006, ISO 14040:2006,
EN 15804:2012, EN 16908:2017

EPD registration number:	S-P-01112
Publication date:	2018-06-07
Validity date:	2023-05-29
Geographical scope:	India

1. Introduction

This current declaration aims to provide the effects measurable and verifiable for the environmental assessment of 1000 kg of average cement (PPC and PSC) manufactured at all the 17 Cement Plants of ACC Limited.

ACC Limited is India's foremost manufacturer of cement and ready mixed concrete with 17 modern cement plants, more than 50 ready mixed concrete plants. The company has a significant presence across India as a brand for Ordinary Portland Cement (OPC), Portland Pozzolana Cement (PPC - IS 1489(Part I):2015) and Portland Slag Cement (PSC - IS 455:2015). The company has been a trendsetter and noted benchmark in cement and concrete technology since it was established in 1936.

The company continuously explores ways to make its business more planet-friendly and this concern is integrated into all activities of the value chain from mining to sales. It has among the lowest carbon footprints in its class. ACC Limited had installed sophisticated pollution control equipment as far back as 1966, long before pollution control laws came into existence. It was among the first Indian companies to include commitment to environmental protection as one of its corporate objectives. Today each cement plant has state-of-the-art pollution control equipment. ACC Limited plants, mines and townships visibly demonstrate successful endeavors in quarry rehabilitation, water management techniques and 'greening' activities. The company actively promotes the use of alternative fuels and resources and offers effective solutions for waste management including testing and co-processing.

This background LCA report is for the EPD of 1000 kg of average cement manufactured at all the 17 Cement Plants of ACC Limited. The EPD is declared for an average cement comprising of 5 brands, namely ACC Suraksha Power, ACC Concrete+ Xtra Strong, ACC Gold Water Shield, ACC HPC Long Life and ACC F2R Superfast from each of the 17 cement plants of ACC Limited. ACC Suraksha Power, ACC Concrete+ Xtra Strong, ACC Gold Water Shield are Portland Pozzolana Cement (PPC - IS 1489(Part I):2015) product type and ACC HPC Long Life, ACC F2R Superfast are the Portland Slag Cement (PSC - IS 455:2015) product type. The LCA is conducted in accordance with EN15804 (Core rules for the product category of construction products) and EN 16908:2017 (sub-PCR Cement and Building Lime) for preparation of Environmental Product Declaration (EPD).

2. General Information

2.1 EPD, PCR, LCA Information

Table 1. EPD Information

Programme	The International EPD® System, www.environdec.com
Program operator	EPD International AB Box 210 60, SE- 100 31 Stockholm, Sweden.
Declaration holder	Mr. K. N. Rao ACC Limited Environment & Energy Conservation Cell ACC Thane Complex, Lal Bahadur Shastri Marg, Thane (West) - 400 604, India Email: narayanarao.kapilavai@acclimited.com
Product	Cement: Portland Pozzolana Cement (PPC) - IS 1489(Part I):2015, Portland Slag Cement (PSC) - IS 455:2015
EPD registration number	S-P-01112
Publication date	2018-06-07
Validity date	2023-05-29
Geographical scope	India
Reference standards	ISO 14020:2001, ISO 14025:2006, ISO 21930:2007, EN 15804:2012, EN 16908:2017

Table 2. PCR Information

Reference PCR	PCR 2012-01 v2.2	EN 16908:2017
Date of Issue	October 2013	February 2017

Table 3: Verification Information

Demonstration of verification	External, independent verification
Third party verifier	Dr Hudai Kara, Metsims Sustainability Consulting, 4 Clear Water Place, Oxford OX2 7NL, UK Email: hudai.kara@metsims.com

Table 4. LCA Information

Title	Environmental Product Declaration of Average Cement
Preparer	Dr. Rajesh Kumar Singh Thinkstep Sustainability Solutions Pvt. Ltd. 421, MIDAS, Sahar Plaza, Andheri Kurla Road, Andheri East, Mumbai, India - 400059 Email: rajesh.singh@thinkstep.com
Reference standards	ISO 14040/44 standard

2.2 Reference Period of EPD Data

The reference period for the data used within this EPD is the year 2016.

2.3 Geographical Scope of EPD Application

The geographical scope of this EPD is India.

2.4 Additional Information about EPD

ACC Limited manufactures Ordinary Portland Cement (OPC), Portland Pozzolana Cement (PPC - IS 1489(Part I):2015) and Portland Slag Cement (PSC - IS 455:2015) at 17 Cement Plants, of which 11 plants have their own clinker production, while the other 6 plants purchase/transfer the clinker from other plants. The EPD is declared for an average cement comprising of 5 brands, namely ACC Suraksha Power, ACC Concrete+ Xtra Strong, ACC Gold Water Shield, ACC HPC Long Life and ACC F2R Superfast from each of the 17 cement plants of ACC Limited. ACC Suraksha Power, ACC Concrete+ Xtra Strong, ACC Gold Water Shield are Portland Pozzolana Cement (PPC) product type and ACC HPC Long Life, ACC F2R Superfast are the Portland Slag Cement (PSC) product type. The target group of EPD are Green Building Certification Program holders and consultants, customers, project developers, statutory agencies and government.

This EPD is in accordance with ISO 14025 and EN 15804. EPD of construction products may not be comparable if they do not comply with EN 15804. Product Category Rules (PCR) for the assessment of the environmental performance of cement is PCR 2012-01 v2.2 Construction products and construction services, compliant with the European standard EN 15804:2012+A1:2013 (Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products) and EN 16908:2017 (sub-PCR Cement and Building Lime). These PCR is applicable to the product 'cement' complying with the standard EN 197-1 (composition, specifications and conformity criteria for common cements).

The environmental impacts are calculated on the basis of the functional unit wherein each flow related to material consumption, energy consumption, emissions, effluent and waste is scaled to the reference flow.

The processes listed below for the production of the final product including primary packaging is included. The processes which are mandatory to be included in plant operation (i.e. clinker production and cement production), in particular are:

- Raw material production (mining and crushing)
- Raw meal preparation
- Clinker production
- Grinding of cement
- Packaging.

The manufacturing of buildings, other capital goods and plant dismantling are not included. Inbound transportation of raw materials and fuel are included and outbound transportation of cement product is not included as per PCR.

3. Product Description and System Boundaries

3.1 Product Identification and Usage

Cement is the most essential raw material in any kind of construction activity. It is used in preparation of concrete, mortar, grout, plaster, etc. Accordingly, cement industry plays a crucial role in the infrastructural development of the country. The present declaration is conducted for 1000 kg of average cement manufactured at 17 plants of ACC Limited.

Table 4. Cement identification and usage

Cement type (product standard)	PPC	PSC
Significant characteristic	High strength, long-term strength	higher ultimate strength, eco-friendly
Application domain	Plastering under aggressive conditions, binder for concrete and mortar	Constructions expected to be attacked by dissolved chlorides and sulphate ions.
Market segment	Hydraulic structures, Mass concreting works Marine structures, Masonry mortars.	Marine and off shore structures, Sewage disposal treatments works, Water treatment plants.

Table 5. Cement composition

Composition	PPC	PSC
Clinker	65%	45-55%
Fly ash/Slag	26-32% (Fly ash)	40-50% (Slag)
Gypsum	4-5%	4-5%
Minor additional constituents	0-6%	0-2%

3.2 Product Manufacturing

The main steps in cement manufacturing process are:

3.2.1 Raw material production (mining and crushing)

Cement uses raw materials that cover calcium, silica, iron and aluminum. Such raw materials are limestone, clay and sand. Limestone is for calcium. It is combined with much smaller proportions of sand and clay. Sand and clay fulfill the need of silicon, iron and aluminum. Limestone is excavated from open cast mines after drilling and blasting and loaded onto dumpers which transport the material and unload into hoppers of the limestone crushers.

3.2.2 Raw meal preparation (grinding, proportioning and blending)

Following extraction of the raw materials, they are crushed and milled into fine powders. These powders are tested and blended to produce a final blend, known as 'raw meal' with a precise chemical composition. After final grinding, the material is ready to face the pre-heating chamber. Pre-heater chamber consists of series of vertical cyclone from where the raw material passes before facing the kiln. Pre-heating chamber utilizes the emitting hot gases from kiln. Pre-heating of the material saves the energy and make plant environmental friendly. The raw meal is pre-heated to temperature in excess of 900°C using the hot gases from the kiln.

3.2.3 Clinker production

Clinker is produced in a rotary kiln, which is a cylindrical steel shell, lined with refractory bricks. The kiln is inclined at 3% and set rotating at a speed of 2-2.2 rpm. The raw mix or corrected slurry is injected into the kiln from its upper end. Burning fuel like powdered coal or petcoke or oil or hot gases are forced through the lower end of the kiln and hot flame is produced. Due to inclined position and slow rotation of the kiln, the material charged from upper end is moving towards lower end (hottest zone) at a speed of 15 meter/hour. As it gradually descends, the temperature rises. In the upper part, water or moisture in the material is evaporated at 400°C temperature, therefore it is known as drying zone.

In the central part (calcination zone), temperature is around 1000°C, where decomposition of limestone takes place. After the escape of CO₂, the remaining material form small lumps called nodules.

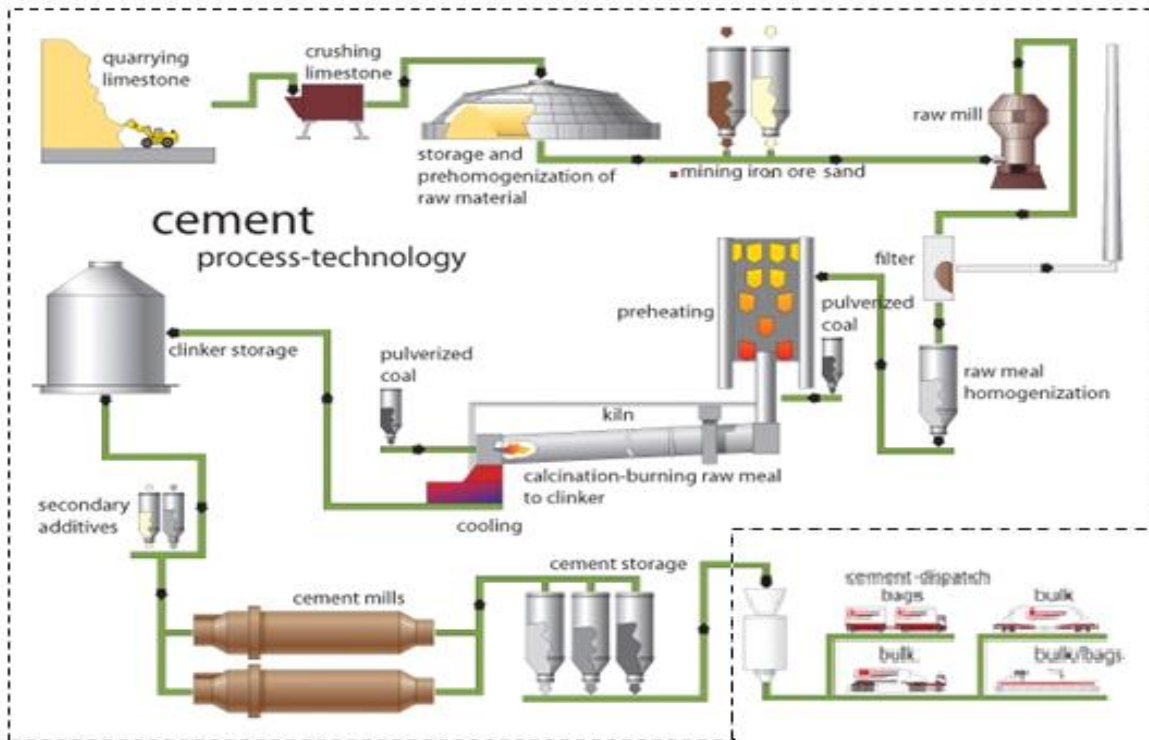
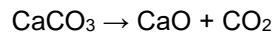
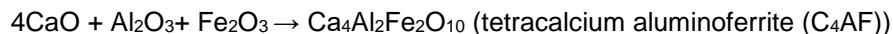
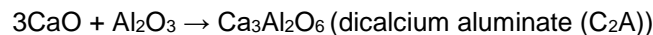
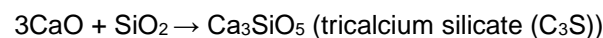
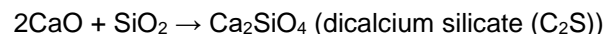


Figure 1: System boundary for the LCA study (A1, A2, A3)



The lower part (clinkering zone) have temperature in between 1500-1700°C, where lime and clay react to yield calcium aluminates and calcium silicates. This aluminates and silicates of calcium fuse together to form small and hard stones, known as clinker. The size of the clinker varies from 5-10 mm.



As clinker is coming from kiln burning zone, it is very hot. It is then immediately quenched in the clinker cooler to stabilize its properties and stored in the clinker store.

3.2.4 Grinding of Cement

The cement mill grinds the clinker to a fine powder. A small amount of gypsum - a form of calcium sulfate - is normally ground up with the clinker. The gypsum controls the setting properties of the cement when water is added. Grinding clinker and gypsum produces Ordinary Portland cement (OPC). Fly ash and slag at required proportion is ground along with clinker and gypsum to produce Portland Pozzolana Cement (PPC) and Portland Slag Cement (PSC), respectively.

3.2.5 Packaging

The cement is then stored in silos and packed in bags using packing machines

3.3 System Boundaries

The selected system boundaries comprise the production of cement including raw material extraction up to the finished product at the factory gate.

Table 6. System boundary and product stages

Module	Product stages
A1	Production of raw materials
A2	Upstream Transport (Inbound transportation)
A3	Manufacturing (Raw meal preparation, Clinker production, Cement grinding)

The system boundary does not include:

- Capital equipment and maintenance of production facility
- Maintenance and operation of support equipment
- Human labor and employee transport

4. LCA

4.1 Information Sources and Data Quality

It is important that data quality is in accordance with the requirements of the LCA's goal and scope. This is essential to the reliability of LCA and achievement of the intended application. The quality of the LCI data for modelling the life cycle stages have been assessed according to ISO 14044 (ISO, 2006b). Data quality is judged by its precision (measured, calculated or estimated), completeness (e.g. are there unreported emissions?), consistency (degree of uniformity of the methodology applied on a LCA serving as a data source) and representativeness (geographical, time period, technology). To cover these requirements and to ensure reliable results, first-hand industry data in combination with consistent, upstream LCA information is used. The datasets have been used in LCA-models worldwide for several years in industrial and scientific applications for internal as well as critically reviewed studies. In the process of providing these datasets, they have been cross-checked with other databases and values from industry and science. ACC Limited provided the most accurate and representative data for cement production. For all data requirements, primary data were used where possible.

4.2 Estimations and Methodology

4.2.1 Allocation procedures

No allocation has been done.

4.2.2 Average cement

The inventory data of the cement produced at all the 17 plants (of which 11 plants have their own clinker production units and the remaining 6 plants purchase/transfer clinker from other plants, i.e. they only have cement grinding unit) are used to calculate the declared average cement. The average is determined based on the produced amounts by weight in 2016.

4.2.3 Declared unit

The declared unit for the EPD is 1000 kg of average Portland Pozzolana Cement (PPC) and Portland Slag Cement (PSC) manufactured at all the 17 cement plants of ACC Limited.

4.2.4 Impact assessment

A list of relevant impact categories and category indicators is defined and associated with the inventory data. Various environmental impacts and emissions are associated with production of precast concrete, from raw material production, transport of materials to manufacturing site to precast concrete production.

CML 2001 (January 2016) method developed by Institute of Environmental Sciences, Leiden University, Netherlands have been selected for evaluation of environmental impacts. These indicators are scientifically and technically valid.

A list of relevant impact categories and category indicators is defined and associated with the inventory data. PCR 2012-01 v2.2 and EN 16908:2017 has been used to conduct the LCA. The PCR identifies the following LCI and LCIA.

1. Potential Environmental Impact (according with EN15804)
 - Global warming potential, GWP (100 years) (kg CO₂ equivalent)
 - Depletion potential of the stratospheric ozone layer, ODP (20 years) (kg CFC-11 equivalent)
 - Acidification potential of soil and water, AP (kg SO₂ equivalent)
 - Eutrophication potential, EP (kg PO₄³⁻ equivalent)
 - Formation potential of tropospheric ozone, POCP (kg Ethene (C₂H₂) equivalent)
 - Abiotic depletion potential (ADP-elements) for non-fossil resources (kg Sb equivalent)
 - Abiotic depletion potential (ADP-fossil fuels) for fossil resources (MJ, net calorific value)
2. Use of Natural Resources (according with EN15804)
 - Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials) (MJ, net calorific value)
 - Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials) (MJ, net calorific value)
 - Use of secondary material (kg)
 - Use of renewable secondary fuels (MJ, net calorific value)
 - Use of non-renewable secondary fuels (MJ, net calorific value)
 - Use of net fresh water (m³)
3. Other Environmental Indicators
 - Components for re-use (kg)
 - Materials for recycling (kg)
 - Materials for energy recovery (kg)
 - Exported energy (MJ)
 - Dust (total dust and PM₁₀) (kg)
 - Hazardous waste (as defined by regional directives) disposed (kg)
 - Non-hazardous waste disposed (kg)
 - Radioactive waste disposed/stored (kg)

4.3 Cut Off Rules

Input and output data have been collected through detailed questionnaires which have been developed and refined. In practice, this means that, at least, all material flows going into the cement production processes (inputs) higher than 1% of the total mass flow (t) or higher than 1% of the total primary energy input (MJ) are part of the system and modelled in order to calculate elementary flows. All material flows leaving the product system (outputs) accounting for more than 1% of the total mass flow is part of the system. All

available inputs and outputs, even below the 1% threshold, have been considered for the LCI calculation. For hazardous and toxic materials and substances the cut-off rules do not apply.

Secondary raw materials used in the production system is accounted adopting the following approach:

- The environmental impacts related to the 'previous life' is not considered.
- The processes needed to prepare the secondary raw material to the new use is considered.
- If the secondary raw material contains energy, the amount is estimated considering the gross calorific value and presented as secondary energy resource.
- If the secondary raw material does not contain energy, the quantity that enter the system is considered as secondary raw material.

4.4 Background Data

All relevant background datasets were taken from the GaBi-8 software database developed by thinkstep AG. To ensure comparability of results in the LCA, the basic data from the GaBi-8 database were used for fuel, energy, transportation and auxiliary materials.

4.5 System Boundaries

4.5.1 Technical system boundaries

The LCA model of 1000 kg of average cement represents a cradle-to-gate system, starting from raw material production (mining and crushing) and ending with the product packaging.

The system boundary and geographical scope includes:

- Extraction and production of raw materials such as limestone.
- Transport of raw materials for the preparation of raw meal and clinker production
- Preparation of raw meal
- Production of clinker using raw meal, limestone and other raw materials.
- Grinding of fly ash, slag, gypsum, grinding aid and other additives with different proportions of clinker.
- Electricity from all sources (import from grid, captive power generation, DG set), Energy, water and raw materials used in the all the above process.
- Emissions to air, effluent discharges and solid waste disposal.

Table 7. Modules of the production life cycle included (X = declared module; MND = module not declared)

Production			Installation		Use stage							End-of-Life				Next product system
Raw material supply	Transport to manufacturer	Manufacturing	Transport to building site	Installation into building	Use / application	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction / demolition	Transport to EoL	Waste processing for reuse, recovery, recycle	Disposal	Reuse, recovery or recycling potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND

4.5.2 Geographical system boundaries

The geographical system boundaries of the LCA cover the production of cement in India. Indian boundaries wherever possible have been adapted.

Table 8. The respective share of ACC cement products for disclosed averaged EPD

Cement Products	Cement production (Tonnes)	Share
Suraksha Power	12,754,144	65.9%
Concrete+ Xtra Strong	929,087	4.80%
Gold Water Shield	574,359	2.97%
HPC Long Life	3,689,530	19.1%
F2R Superfast	1,398,535	7.23%
Total	19,345,657	100%

4.5.3 Temporal system boundaries

The data collection is related to one year of operation and the year of the data is indicated in the questionnaire for each data point. The majority of data was derived from the period January 2016 to December 2016.

4.6 Comparability

The EPD is established on the basis of the PCR 2012-01 v2.2 compliant to EN 15804 and EN 16908:2017 (sub-PCR Cement and Building Lime). According to these standards, EPDs do not compare the environmental performance of products in the construction sector. Any comparison of the declared environmental performance of products lies outside the scope of these standards and is suggested to be feasible only if all compared declarations follow equal standard provisions.

4.7 Results

The LCIA result of overall 17 cement plants of ACC Limited together given below have been calculated taking the weighted average of all the 38 products of 5 brands of PPC and PSC in 17 ACC Limited cement plants. The following results excludes the impact of OPC production.

Table 9.LCIA result for 1000 kg average cement

LCIA Impact Category	Unit	Module A1- A3
Abiotic Depletion (ADP elements)	kg Sb-Eq.	7.38E-04
Abiotic Depletion (ADP Fossil)	MJ	3.94E+03
Acidification Potential (AP)	kg SO ₂ -Eq.	2.15E+00
Eutrophication Potential (EP)	kg Phosphate-Eq.	2.90E-01
Global Warming Potential (GWP)	kg CO ₂ -Eq.	6.88E+02
Ozone Layer Depletion Potential (ODP)	kg CFC11-Eq.	6.02E-10
Photochemical Ozone Creation Potential (POCP)	kg Ethene-Eq.	1.30E-01

Table 10. Use of natural resources for 1000 kg average cement

Parameters	Unit	Module A1- A3
Renewable primary energy as energy carrier	MJ	3.89E+01
Renewable primary energy resources as raw materials	MJ	0.00E00
Total renewable primary energy resources (primary energy and primary energy resources as raw materials)	MJ	3.89E+01
Non- renewable primary energy as energy carrier	MJ	3.95E+03
Non- renewable primary energy resources as raw materials	MJ	0.00E00
Total non- renewable primary energy resources (primary energy and primary energy resources as raw materials)	MJ	3.95E+03
Use of secondary material	kg	4.15E+02
Use of renewable secondary fuels	MJ	1.25E+01
Use of non- renewable secondary fuels	MJ	6.16E+01
Use of net fresh water	m ³	6.65E-01

Table 11. Other indicators for 1000 kg average cement

Parameters	Unit	Module A1-A3
Components for reuse	kg	0.00
Materials for recycling	kg	0.00
Materials for energy recovery	kg	0.00
Exported energy	MJ	0.00

Table 12. Supplementary indicators for 1000 kg average cement

Parameters	Unit	Module A1-A3
Non-hazardous waste	kg	1.30E-01
Hazardous waste	kg	2.62E-03
Radioactive waste	kg	0.00E00

4.8 Interpretation

Table 13. Interpretation of life cycle parameters for 1000 kg average cement

Parameter	Interpretation
ADP elements	Abiotic depletion potential (ADP element) is 7.38E-04 kg Sb-Equiv. of which 99.5% contribution is from cement production. Clinker production contributes 0.203% total ADP element. Packaging of cement contributes 0.155% of ADP elements. Raw meal preparation and mining process contributes 0.0440% and 0.0170%, respectively. Considering cement grinding process impacts as 100%, gypsum contributes 99.9%. Considering clinker production impacts as 100%, 71.6% is given by petrol coke.
ADP Fossil	Abiotic depletion potential (ADP Fossil) is 3.94E+03 MJ of which 70.8% is contributed by clinker production. The process of cement grinding contributes 15.5% of ADP fossil. Packaging gives 3.26% of ADP-fossil. Considering clinker production impacts as 100%, 47.8% is given by coal mix, 28.7% is given by petrol coke and 21.8% is given by electricity mix used for clinker production. Considering cement grinding process impacts as 100%, 93.3% is given by electricity mix used for grinding and gypsum gives 4.60%.
Acidification Potential	Acidification Potential is 2.15E+00 kg SO ₂ -Equiv. The contribution of clinker production is 76.8%. Grinding of cement contributes 11.3%, raw material production gives 2.49% of acidification potential. Considering clinker production impacts as 100%, 73.8% acidification potential is contributed by the air emissions in clinker production and 6.36% is given by production emissions of petrol coke. Considering cement grinding process impacts as 100%, electricity mix alone contributes 97.9% due to production emission of coal in CPP. Considering raw material production impacts as 100%, 63.4% is due to combustion of diesel used in mining process.
Eutrophication Potential	Eutrophication Potential is 2.90E-01 kg Phosphate-Equiv. The contribution of clinker production is highest with 88.1%, cement grinding process contributes 2.87%, while mining and raw meal preparation contributes 0.620% and 0.0470%, respectively. Considering clinker production impacts as 100%, 92.1% is contributed by various air emissions from kiln, 2.36% is given by coal mix and 1.34% is contributed by petrol coke and 3.15% is due to emissions from Captive power plant.
Global Warming Potential	Global Warming Potential is 6.88E+02 kg CO ₂ -Equiv. The contribution of clinker production is 87.5%, cement grinding process contributes 7.04%, mining process gives 0.920%, packaging contributes 0.780%, while raw meal preparation and ETP-RO plant contributes the least. Considering clinker production impacts as 100%, limestone emission contributes highest with 58.5%, coal emission contributes 17.0%, coal emissions from CPP electricity used for clinker production contributes 8.00%. Considering cement grinding process impacts as 100%, maximum contribution is done by the coal emissions from CPP electricity used in grinding. Considering mining process impacts as 100%, 37.0% is contributed by combustion of diesel used for thermal energy and 55.3% by the emissions from CPP electricity production.

Ozone Depletion Potential	Ozone Layer Depletion Potential is 6.02E-10 kg CFC11-Equiv. The contribution of cement grinding process is highest with 43.2%, clinker production contributes 35.5%, cement packaging process contributes 9.77%, mining process contributes 5.91%. Considering the cement grinding process impacts as 100%, 70.5% is contributed by grinding aid and 16.3% by the emissions from CPP in electricity mix. Considering clinker production impacts as 100%, 46.5% and 30.4% is contributed by the coal emissions and petrol coke emissions respectively.
Primary Energy Demand	Primary Energy Demand is 3.98E+03 MJ. The contribution of clinker production is 70.6%, cement grinding process contributes 15.6%, packaging contributes 3.30%, mining and raw meal preparation contributes 1.90% and 0.200% respectively. Considering clinker production impacts as 100%, coal combustion contributes 47.8% and that of petrol coke gives 28.8%, while 21.8% is from captive power plant. Considering cement grinding process impacts as 100%, fuel combustion in captive power plant contributes 92.5% primary energy demand.
Photochemical Ozone Creation Potential	Photochemical Ozone Creation Potential is 1.30E-01 kg Ethene-Equiv. The major contribution of POCP comes from clinker production i.e. 89.4%, cement grinding process contributes 10.7%, mining process gives 2.39%, ETP-RO plant and packaging process both contributes 1.68% each. Considering clinker production impacts as 100%, 72.1% is given by air emissions from the kiln and petrol coke production emission contributes 11.5%.
Waste Generation	The total amount of hazardous waste generated is 2.62E-03 kg and the non-hazardous waste is 1.30E-01 kg, while no radioactive waste is generated. Most of the hazardous waste is contributed by cement grinding process with 94.6% and clinker production giving 3.75%. The non-hazardous waste is coming from clinker production with 29.6% and 27.4% from gypsum and grinding aid in cement grinding process.
Water Demand	The net fresh water used is 6.65E-01 m ³

5. Other Environmental Information

The constituent materials used within our products are responsibly sourced and we apply the principles of Sustainable Development and of Environmental Stewardship as a standard business practice in our operations. Protecting the environment by preserving non-renewable natural resources, increasing energy efficiency, reducing the environmental emissions, limiting the impact of materials transportation to and from our operations is part of our way in doing business.

Products do not contain any substances that can be included in “Candidate List of Substances of Very High Concern for Authorization” and raw materials used are not part of the EU REACH regulation.

6. References

- EN 15804:2012+A1:2013, Sustainability of construction works - Environmental Product Declarations - Core rules for the product category of construction products
- PCR for Construction Products and CPC 54 Construction Services/ Prepared by IVL Swedish Environmental Research Institute, Swedish Environmental Protection Agency, SP Trä, Swedish Wood Preservation Institute, Swedisol, SCDA, Svenskt Limträ AB, SSAB, The International EPD System, 2012:01 Version 2.2, Date 2017-05-30.
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- GABI 8: 2017. thinkstep AG; GaBi 8: Software-System and Database for Life Cycle Engineering. Copyright. Leinfelden, Echterdingen, 1992-2017.
- ISO 14020:2001 Environmental labels and declarations - General principles
- ISO 14025:2006 Environmental labels and declarations - Type III environmental declarations - Principles and procedures
- ISO 14040:2006 Environmental management - Life cycle assessment - Principles and framework
- ISO 14044:2006 Environmental management - Life cycle assessment - Requirements and guidelines
- ISO 21930:2007 Sustainability in building construction - Environmental declaration of building products.
- IS 455-2015- Portland Slag Cement Specification (5th Revision), Bureau of Indian Standards, December 2015.
- IS 1489 part 1-Portland Pozzolana Cement-Specification (4rd Revision), Bureau of Indian Standards, December 2015.

7. Annexure

7.1 LCIA of 5 cement brands for combined 17 cement plants of ACC Limited

7.1.1 ACC Suraksha Power Cement

LCIA	A1-A3
Global Warming Potential (GWP 100 years) [kg CO ₂ -Equiv.]	7.28E+02
Ozone Layer Depletion Potential (ODP, steady state) [kg CFC11-Equiv.]	6.27E-10
Acidification Potential (AP) [kg SO ₂ -Equiv.]	2.09E+00
Eutrophication Potential (EP) [kg Phosphate-Equiv.]	2.90E-01
Photochemical Ozone Creation Potential (POCP) [kg Ethene-Equiv.]	1.20E-01
Abiotic Depletion Potential (ADP elements) [kg Sb-Equiv.]	7.47E-04
Abiotic Depletion Potential (ADP-fossil fuels) (net cal. value) [MJ]	4.15E+03
Use of renewable primary energy excluding renewable primary energy resources used as raw materials (PERE) (net cal. value) [MJ]	3.85E+01
Use of renewable primary energy resources used as raw materials (PERM) (net cal. value) [MJ]	0.00E+00
Total use of renewable primary energy resources (PERT) (net cal. value) [MJ]	3.85E+01
Use of non- renewable primary energy excluding non- renewable primary energy resources used as raw materials (PENRE) (net cal. value) [MJ]	4.16E+03
Use of non- renewable primary energy resources used as raw Materials (PENRM) (net cal. value) [MJ]	0.00E+00
Total use of non- renewable primary energy resources (PENRT) (net cal. value) [MJ]	4.16E+03
Use of secondary material [kg]	3.77E+02
Use of renewable secondary fuels (net cal. value) [MJ]	1.67E+01
Use of non- renewable secondary fuels (net cal. value) [MJ]	7.87E+01
Use of net fresh water [m ³]	6.30E-01
Hazardous waste disposed [kg]	2.59E-03
Non-hazardous waste disposed [kg]	1.50E-01
Radioactive waste disposed/stored [kg]	0.00E+00
Components for re-use [kg]	0.00E+00
Materials for recycling [kg]	0.00E+00
Materials for energy recovery [kg]	0.00E+00
Exported energy [MJ]	0.00E+00
Electricity use [kWh]	6.57E+01
Dust (kg)	4.00E-02

7.1.2 ACC Concrete+ Xtra Strong Cement

LCIA	A1-A3
Global Warming Potential (GWP 100 years) [kg CO ₂ -Equiv.]	8.13E+02
Ozone Layer Depletion Potential (ODP, steady state) [kg CFC11-Equiv.]	4.70E-10
Acidification Potential (AP) [kg SO ₂ -Equiv.]	3.11E+00
Eutrophication Potential (EP) [kg Phosphate-Equiv.]	2.80E-01
Photochemical Ozone Creation Potential (POCP) [kg Ethene-Equiv.]	1.70E-01
Abiotic Depletion Potential (ADP elements) [kg Sb-Equiv.]	7.58E-04
Abiotic Depletion Potential (ADP-fossil fuels) (net cal. value) [MJ]	4.80E+03
Use of renewable primary energy excluding renewable primary energy resources used as raw materials (PERE) (net cal. value) [MJ]	3.16E+01
Use of renewable primary energy resources used as raw materials (PERM) (net cal. value) [MJ]	0.00E+00
Total use of renewable primary energy resources (PERT) (net cal. value) [MJ]	3.16E+01
Use of non- renewable primary energy excluding non- renewable primary energy resources used as raw materials (PENRE) (net cal. value) [MJ]	4.81E+03
Use of non- renewable primary energy resources used as raw Materials (PENRM) (net cal. value) [MJ]	0.00E+00
Total use of non- renewable primary energy resources (PENRT) (net cal. value) [MJ]	4.81E+03
Use of secondary material [kg]	3.04E+02
Use of renewable secondary fuels (net cal. value) [MJ]	1.55E+00
Use of non- renewable secondary fuels (net cal. value) [MJ]	7.35E+01
Use of net fresh water [m ³]	1.17E+00
Hazardous waste disposed [kg]	8.94E-04
Non-hazardous waste disposed [kg]	9.00E-02
Radioactive waste disposed/stored [kg]	0.00E+00
Components for re-use [kg]	0.00E+00
Materials for recycling [kg]	0.00E+00
Materials for energy recovery [kg]	0.00E+00
Exported energy [MJ]	0.00E+00
Electricity use [kWh]	6.98E+01
Dust [kg]	3.00E-02

7.1.3 ACC Gold Water Shield Cement

LCIA	A1-A3
Global Warming Potential (GWP 100 years) [kg CO ₂ -Equiv.]	6.89E+02
Ozone Layer Depletion Potential (ODP, steady state) [kg CFC11-Equiv.]	6.55E-10
Acidification Potential (AP) [kg SO ₂ -Equiv.]	2.01E+00
Eutrophication Potential (EP) [kg Phosphate-Equiv.]	3.50E-01
Photochemical Ozone Creation Potential (POCP) [kg Ethene-Equiv.]	1.20E-01
Abiotic Depletion Potential (ADP elements) [kg Sb-Equiv.]	7.57E-04
Abiotic Depletion Potential (ADP-fossil fuels) (net cal. value) [MJ]	3.69E+03
Use of renewable primary energy excluding renewable primary energy resources used as raw materials (PERE) (net cal. value) [MJ]	4.78E+01
Use of renewable primary energy resources used as raw materials (PERM) (net cal. value) [MJ]	0.00E+00
Total use of renewable primary energy resources (PERT) (net cal. value) [MJ]	4.78E+01
Use of non- renewable primary energy excluding non- renewable primary energy resources used as raw materials (PENRE) (net cal. value) [MJ]	3.70E+03
Use of non- renewable primary energy resources used as raw Materials (PENRM) (net cal. value) [MJ]	0.00E+00
Total use of non- renewable primary energy resources (PENRT) (net cal. value) [MJ]	3.70E+03
Use of secondary material [kg]	3.73E+02
Use of renewable secondary fuels (net cal. value) [MJ]	2.39E+01
Use of non- renewable secondary fuels (net cal. value) [MJ]	7.29E+01
Use of net fresh water [m ³]	6.70E-01
Hazardous waste disposed [kg]	2.90E-03
Non-hazardous waste disposed [kg]	1.90E-01
Radioactive waste disposed/stored [kg]	0.00E+00
Components for re-use [kg]	0.00E+00
Materials for recycling [kg]	0.00E+00
Materials for energy recovery [kg]	0.00E+00
Exported energy [MJ]	0.00E+00
Electricity use [kWh]	6.13E+01
Dust [kg]	4.00E-02

7.1.4 ACC HPC Long Life Cement

LCIA	A1-A3
Global Warming Potential (GWP 100 years) [kg CO ₂ -Equiv.]	5.32E+02
Ozone Layer Depletion Potential (ODP, steady state) [kg CFC11-Equiv.]	5.30E-10
Acidification Potential (AP) [kg SO ₂ -Equiv.]	2.08E+00
Eutrophication Potential (EP) [kg Phosphate-Equiv.]	2.50E-01
Photochemical Ozone Creation Potential (POCP) [kg Ethene-Equiv.]	1.20E-01
Abiotic Depletion Potential (ADP elements) [kg Sb-Equiv.]	7.12E-04
Abiotic Depletion Potential (ADP-fossil fuels) (net cal. value) [MJ]	3.11E+03
Use of renewable primary energy excluding renewable primary energy resources used as raw materials (PERE) (net cal. value) [MJ]	3.93E+01
Use of renewable primary energy resources used as raw materials (PERM) (net cal. value) [MJ]	0.00E+00
Total use of renewable primary energy resources (PERT) (net cal. value) [MJ]	3.93E+01
Use of non- renewable primary energy excluding non- renewable primary energy resources used as raw materials (PENRE) (net cal. value) [MJ]	3.12E+03
Use of non- renewable primary energy resources used as raw Materials (PENRM) (net cal. value) [MJ]	0.00E+00
Total use of non- renewable primary energy resources (PENRT) (net cal. value) [MJ]	3.12E+03
Use of secondary material [kg]	5.64E+02
Use of renewable secondary fuels (net cal. value) [MJ]	2.20E+00
Use of non- renewable secondary fuels (net cal. value) [MJ]	1.21E+01
Use of net fresh water [m ³]	5.70E-01
Hazardous waste disposed [kg]	2.85E-03
Non-hazardous waste disposed [kg]	7.66E-02
Radioactive waste disposed/stored [kg]	0.00E+00
Components for re-use [kg]	0.00E+00
Materials for recycling [kg]	0.00E+00
Materials for energy recovery [kg]	0.00E+00
Exported energy [MJ]	0.00E+00
Electricity use [kWh]	6.91E+01
Dust [kg]	3.00E-02

7.1.5 ACC F2R Superfast Cement

LCIA	A1-A3
Global Warming Potential (GWP 100 years) [kg CO ₂ -Equiv.]	6.64E+02
Ozone Layer Depletion Potential (ODP, steady state) [kg CFC11-Equiv.]	6.32E-10
Acidification Potential (AP) [kg SO ₂ -Equiv.]	2.30E+00
Eutrophication Potential (EP) [kg Phosphate-Equiv.]	3.40E-01
Photochemical Ozone Creation Potential (POCP) [kg Ethene-Equiv.]	1.40E-01
Abiotic Depletion Potential (ADP elements) [kg Sb-Equiv.]	7.08E-04
Abiotic Depletion Potential (ADP-fossil fuels) (net cal. value) [MJ]	3.79E+03
Use of renewable primary energy excluding renewable primary energy resources used as raw materials (PERE) (net cal. value) [MJ]	4.23E+01
Use of renewable primary energy resources used as raw materials (PERM) (net cal. value) [MJ]	0.00E+00
Total use of renewable primary energy resources (PERT) (net cal. value) [MJ]	4.23E+01
Use of non- renewable primary energy excluding non- renewable primary energy resources used as raw materials (PENRE) (net cal. value) [MJ]	3.80E+03
Use of non- renewable primary energy resources used as raw Materials (PENRM) (net cal. value) [MJ]	0.00E+00
Total use of non- renewable primary energy resources (PENRT) (net cal. value) [MJ]	3.80E+03
Use of secondary material [kg]	4.55E+02
Use of renewable secondary fuels (net cal. value) [MJ]	4.38E+00
Use of non- renewable secondary fuels (net cal. value) [MJ]	2.62E+01
Use of net fresh water [m ³]	9.10E-01
Hazardous waste disposed [kg]	3.40E-03
Non-hazardous waste disposed [kg]	9.00E-02
Radioactive waste disposed/stored [kg]	0.00E+00
Components for re-use [kg]	0.00E+00
Materials for recycling [kg]	0.00E+00
Materials for energy recovery [kg]	0.00E+00
Exported energy [MJ]	0.00E+00
Electricity use [kWh]	7.56E+01
Dust [kg]	5.00E-02

7.2 LCIA of cement products for Bargarh plant

7.2.1 Bargarh - ACC F2R Superfast Cement

LCIA	A1-A3
Global Warming Potential (GWP 100 years) [kg CO ₂ -Equiv.]	7.68E+02
Ozone Layer Depletion Potential (ODP, steady state) [kg CFC11-Equiv.]	1.21E-09
Acidification Potential (AP) [kg SO ₂ -Equiv.]	3.39E+00
Eutrophication Potential (EP) [kg Phosphate-Equiv.]	5.80E-01
Photochemical Ozone Creation Potential (POCP) [kg Ethene-Equiv.]	2.10E-01
Abiotic Depletion Potential (ADP elements) [kg Sb-Equiv.]	7.60E-04
Abiotic Depletion Potential (ADP-fossil fuels) (net cal. value) [MJ]	5.37E+03
Use of renewable primary energy excluding renewable primary energy resources used as raw materials (PERE) (net cal. value) [MJ]	3.01E+01
Use of renewable primary energy resources used as raw materials (PERM) (net cal. value) [MJ]	0.00E+00
Total use of renewable primary energy resources (PERT) (net cal. value) [MJ]	3.01E+01
Use of non- renewable primary energy excluding non- renewable primary energy resources used as raw materials (PENRE) (net cal. value) [MJ]	5.38E+03
Use of non- renewable primary energy resources used as raw Materials (PENRM) (net cal. value) [MJ]	0.00E+00
Total use of non- renewable primary energy resources (PENRT) (net cal. value) [MJ]	5.38E+03
Use of secondary material [kg]	4.55E+02
Use of renewable secondary fuels (net cal. value) [MJ]	4.68E+00
Use of non- renewable secondary fuels (net cal. value) [MJ]	1.85E+01
Use of net fresh water [m ³]	2.92E+00
Hazardous waste disposed [kg]	8.51E-03
Non-hazardous waste disposed [kg]	1.10E-01
Radioactive waste disposed/stored [kg]	0.00E+00
Components for re-use [kg]	0.00E+00
Materials for recycling [kg]	0.00E+00
Materials for energy recovery [kg]	0.00E+00
Exported energy [MJ]	0.00E+00
Electricity use [kWh]	9.72E+01
Dust [kg]	1.00E-01

7.2.2 Bargarh - ACC HPC Long Life Cement

LCIA	A1-A3
Global Warming Potential (GWP 100 years) [kg CO ₂ -Equiv.]	6.01E+02
Ozone Layer Depletion Potential (ODP, steady state) [kg CFC11-Equiv.]	1.14E-09
Acidification Potential (AP) [kg SO ₂ -Equiv.]	2.67E+00
Eutrophication Potential (EP) [kg Phosphate-Equiv.]	4.40E-01
Photochemical Ozone Creation Potential (POCP) [kg Ethene-Equiv.]	1.70E-01
Abiotic Depletion Potential (ADP elements) [kg Sb-Equiv.]	7.59E-04
Abiotic Depletion Potential (ADP-fossil fuels) (net cal. value) [MJ]	4.50E+03
Use of renewable primary energy excluding renewable primary energy resources used as raw materials (PERE) (net cal. value) [MJ]	2.72E+01
Use of renewable primary energy resources used as raw materials (PERM) (net cal. value) [MJ]	0.00E+00
Total use of renewable primary energy resources (PERT) (net cal. value) [MJ]	2.72E+01
Use of non- renewable primary energy excluding non- renewable primary energy resources used as raw materials (PENRE) (net cal. value) [MJ]	4.51E+03
Use of non- renewable primary energy resources used as raw Materials (PENRM) (net cal. value) [MJ]	0.00E+00
Total use of non- renewable primary energy resources (PENRT) (net cal. value) [MJ]	4.51E+03
Use of secondary material [kg]	5.91E+02
Use of renewable secondary fuels (net cal. value) [MJ]	3.46E+00
Use of non- renewable secondary fuels (net cal. value) [MJ]	1.37E+01
Use of net fresh water [m ³]	1.80E+00
Hazardous waste disposed [kg]	8.34E-03
Non-hazardous waste disposed [kg]	9.00E-02
Radioactive waste disposed/stored [kg]	0.00E+00
Components for re-use [kg]	0.00E+00
Materials for recycling [kg]	0.00E+00
Materials for energy recovery [kg]	0.00E+00
Exported energy [MJ]	0.00E+00
Electricity use [kWh]	8.78E+01
Dust [kg]	8.00E-02

7.2.3 Bargarh - ACC Suraksha Power Cement

LCIA	A1-A3
Global Warming Potential (GWP 100 years) [kg CO ₂ -Equiv.]	9.92E+02
Ozone Layer Depletion Potential (ODP, steady state) [kg CFC11-Equiv.]	1.29E-09
Acidification Potential (AP) [kg SO ₂ -Equiv.]	4.38E+00
Eutrophication Potential (EP) [kg Phosphate-Equiv.]	7.70E-01
Photochemical Ozone Creation Potential (POCP) [kg Ethene-Equiv.]	2.80E-01
Abiotic Depletion Potential (ADP elements) [kg Sb-Equiv.]	7.60E-04
Abiotic Depletion Potential (ADP-fossil fuels) (net cal. value) [MJ]	6.50E+03
Use of renewable primary energy excluding renewable primary energy resources used as raw materials (PERE) (net cal. value) [MJ]	3.38E+01
Use of renewable primary energy resources used as raw materials (PERM) (net cal. value) [MJ]	0.00E+00
Total use of renewable primary energy resources (PERT) (net cal. value) [MJ]	3.38E+01
Use of non- renewable primary energy excluding non- renewable primary energy resources used as raw materials (PENRE) (net cal. value) [MJ]	6.51E+03
Use of non- renewable primary energy resources used as raw Materials (PENRM) (net cal. value) [MJ]	0.00E+00
Total use of non- renewable primary energy resources (PENRT) (net cal. value) [MJ]	6.51E+03
Use of secondary material [kg]	2.70E+02
Use of renewable secondary fuels (net cal. value) [MJ]	6.33E+00
Use of non- renewable secondary fuels (net cal. value) [MJ]	2.50E+01
Use of net fresh water [m ³]	4.98E+00
Hazardous waste disposed [kg]	8.55E-03
Non-hazardous waste disposed [kg]	1.30E-01
Radioactive waste disposed/stored [kg]	0.00E+00
Components for re-use [kg]	0.00E+00
Materials for recycling [kg]	0.00E+00
Materials for energy recovery [kg]	0.00E+00
Exported energy [MJ]	0.00E+00
Electricity use [kWh]	1.08E+02
Dust [kg]	1.20E-01

7.3 LCIA of cement products for Chanda plant

7.3.1 Chanda - ACC Concrete+ Xtra Strong Cement

LCIA	A1-A3
Global Warming Potential (GWP 100 years) [kg CO ₂ -Equiv.]	8.14E+02
Ozone Layer Depletion Potential (ODP, steady state) [kg CFC11-Equiv.]	3.71E-10
Acidification Potential (AP) [kg SO ₂ -Equiv.]	5.49E+00
Eutrophication Potential (EP) [kg Phosphate-Equiv.]	2.70E-01
Photochemical Ozone Creation Potential (POCP) [kg Ethene-Equiv.]	2.70E-01
Abiotic Depletion Potential (ADP elements) [kg Sb-Equiv.]	7.55E-04
Abiotic Depletion Potential (ADP-fossil fuels) (net cal. value) [MJ]	5.19E+03
Use of renewable primary energy excluding renewable primary energy resources used as raw materials (PERE) (net cal. value) [MJ]	2.27E+01
Use of renewable primary energy resources used as raw materials (PERM) (net cal. value) [MJ]	0.00E+00
Total use of renewable primary energy resources (PERT) (net cal. value) [MJ]	2.27E+01
Use of non- renewable primary energy excluding non- renewable primary energy resources used as raw materials (PENRE) (net cal. value) [MJ]	5.19E+03
Use of non- renewable primary energy resources used as raw Materials (PENRM) (net cal. value) [MJ]	0.00E+00
Total use of non- renewable primary energy resources (PENRT) (net cal. value) [MJ]	5.19E+03
Use of secondary material [kg]	2.63E+02
Use of renewable secondary fuels (net cal. value) [MJ]	0.00E+00
Use of non- renewable secondary fuels (net cal. value) [MJ]	3.11E+01
Use of net fresh water [m ³]	2.52E+00
Hazardous waste disposed [kg]	3.43E-04
Non-hazardous waste disposed [kg]	8.00E-02
Radioactive waste disposed/stored [kg]	0.00E+00
Components for re-use [kg]	0.00E+00
Materials for recycling [kg]	0.00E+00
Materials for energy recovery [kg]	0.00E+00
Exported energy [MJ]	0.00E+00
Electricity use [kWh]	5.83E+01
Dust [kg]	6.00E-02

7.3.2 Chanda - ACC Suraksha Power Cement

LCIA	A1-A3
Global Warming Potential (GWP 100 years) [kg CO ₂ -Equiv.]	6.88E+02
Ozone Layer Depletion Potential (ODP, steady state) [kg CFC11-Equiv.]	3.29E-10
Acidification Potential (AP) [kg SO ₂ -Equiv.]	4.90E+00
Eutrophication Potential (EP) [kg Phosphate-Equiv.]	2.40E-01
Photochemical Ozone Creation Potential (POCP) [kg Ethene-Equiv.]	2.40E-01
Abiotic Depletion Potential (ADP elements) [kg Sb-Equiv.]	7.55E-04
Abiotic Depletion Potential (ADP-fossil fuels) (net cal. value) [MJ]	4.48E+03
Use of renewable primary energy excluding renewable primary energy resources used as raw materials (PERE) (net cal. value) [MJ]	2.05E+01
Use of renewable primary energy resources used as raw materials (PERM) (net cal. value) [MJ]	0.00E+00
Total use of renewable primary energy resources (PERT) (net cal. value) [MJ]	2.05E+01
Use of non- renewable primary energy excluding non- renewable primary energy resources used as raw materials (PENRE) (net cal. value) [MJ]	4.48E+03
Use of non- renewable primary energy resources used as raw Materials (PENRM) (net cal. value) [MJ]	0.00E+00
Total use of non- renewable primary energy resources (PENRT) (net cal. value) [MJ]	4.48E+03
Use of secondary material [kg]	3.83E+02
Use of renewable secondary fuels (net cal. value) [MJ]	0.00E+00
Use of non- renewable secondary fuels (net cal. value) [MJ]	2.90E+01
Use of net fresh water [m ³]	1.03E+00
Hazardous waste disposed [kg]	3.24E-04
Non-hazardous waste disposed [kg]	7.00E-02
Radioactive waste disposed/stored [kg]	0.00E+00
Components for re-use [kg]	0.00E+00
Materials for recycling [kg]	0.00E+00
Materials for energy recovery [kg]	0.00E+00
Exported energy [MJ]	0.00E+00
Electricity use [kWh]	5.40E+01
Dust [kg]	5.00E-02

7.4 LCIA of cement products for Chaibasa plant

7.4.1 Chaibasa - ACC F2R Superfast Cement

LCIA	A1-A3
Global Warming Potential (GWP 100 years) [kg CO ₂ -Equiv.]	6.65E+02
Ozone Layer Depletion Potential (ODP, steady state) [kg CFC11-Equiv.]	4.24E-10
Acidification Potential (AP) [kg SO ₂ -Equiv.]	2.50E+00
Eutrophication Potential (EP) [kg Phosphate-Equiv.]	4.50E-01
Photochemical Ozone Creation Potential (POCP) [kg Ethene-Equiv.]	1.60E-01
Abiotic Depletion Potential (ADP elements) [kg Sb-Equiv.]	5.32E-04
Abiotic Depletion Potential (ADP-fossil fuels) (net cal. value) [MJ]	4.56E+03
Use of renewable primary energy excluding renewable primary energy resources used as raw materials (PERE) (net cal. value) [MJ]	2.35E+01
Use of renewable primary energy resources used as raw materials (PERM) (net cal. value) [MJ]	0.00E+00
Total use of renewable primary energy resources (PERT) (net cal. value) [MJ]	2.35E+01
Use of non- renewable primary energy excluding non- renewable primary energy resources used as raw materials (PENRE) (net cal. value) [MJ]	4.57E+03
Use of non- renewable primary energy resources used as raw Materials (PENRM) (net cal. value) [MJ]	0.00E+00
Total use of non- renewable primary energy resources (PENRT) (net cal. value) [MJ]	4.57E+03
Use of secondary material [kg]	4.82E+02
Use of renewable secondary fuels (net cal. value) [MJ]	0.00E+00
Use of non- renewable secondary fuels (net cal. value) [MJ]	2.98E+01
Use of net fresh water [m ³]	5.80E-01
Hazardous waste disposed [kg]	7.67E-04
Non-hazardous waste disposed [kg]	8.00E-02
Radioactive waste disposed/stored [kg]	0.00E+00
Components for re-use [kg]	0.00E+00
Materials for recycling [kg]	0.00E+00
Materials for energy recovery [kg]	0.00E+00
Exported energy [MJ]	0.00E+00
Electricity use [kWh]	7.50E+01
Dust [kg]	1.30E-01

7.4.2 Chaibasa - ACC HPC Long Life Cement

LCIA	A1-A3
Global Warming Potential (GWP 100 years) [kg CO ₂ -Equiv.]	5.52E+02
Ozone Layer Depletion Potential (ODP, steady state) [kg CFC11-Equiv.]	3.54E-10
Acidification Potential (AP) [kg SO ₂ -Equiv.]	2.12E+00
Eutrophication Potential (EP) [kg Phosphate-Equiv.]	3.80E-01
Photochemical Ozone Creation Potential (POCP) [kg Ethene-Equiv.]	1.40E-01
Abiotic Depletion Potential (ADP elements) [kg Sb-Equiv.]	3.78E-04
Abiotic Depletion Potential (ADP-fossil fuels) (net cal. value) [MJ]	3.96E+03
Use of renewable primary energy excluding renewable primary energy resources used as raw materials (PERE) (net cal. value) [MJ]	2.02E+01
Use of renewable primary energy resources used as raw materials (PERM) (net cal. value) [MJ]	0.00E+00
Total use of renewable primary energy resources (PERT) (net cal. value) [MJ]	2.02E+01
Use of non- renewable primary energy excluding non- renewable primary energy resources used as raw materials (PENRE) (net cal. value) [MJ]	3.97E+03
Use of non- renewable primary energy resources used as raw Materials (PENRM) (net cal. value) [MJ]	0.00E+00
Total use of non- renewable primary energy resources (PENRT) (net cal. value) [MJ]	3.97E+03
Use of secondary material [kg]	5.90E+02
Use of renewable secondary fuels (net cal. value) [MJ]	0.00E+00
Use of non- renewable secondary fuels (net cal. value) [MJ]	2.38E+01
Use of net fresh water [m ³]	5.30E-01
Hazardous waste disposed [kg]	5.62E-04
Non-hazardous waste disposed [kg]	7.00E-02
Radioactive waste disposed/stored [kg]	0.00E+00
Components for re-use [kg]	0.00E+00
Materials for recycling [kg]	0.00E+00
Materials for energy recovery [kg]	0.00E+00
Exported energy [MJ]	0.00E+00
Electricity use [kWh]	6.92E+01
Dust [kg]	1.10E-01

7.4.3 Chaibasa - ACC Suraksha Power Cement

LCIA	A1-A3
Global Warming Potential (GWP 100 years) [kg CO ₂ -Equiv.]	8.37E+02
Ozone Layer Depletion Potential (ODP, steady state) [kg CFC11-Equiv.]	5.26E-10
Acidification Potential (AP) [kg SO ₂ -Equiv.]	3.08E+00
Eutrophication Potential (EP) [kg Phosphate-Equiv.]	5.70E-01
Photochemical Ozone Creation Potential (POCP) [kg Ethene-Equiv.]	2.10E-01
Abiotic Depletion Potential (ADP elements) [kg Sb-Equiv.]	7.60E-04
Abiotic Depletion Potential (ADP-fossil fuels) (net cal. value) [MJ]	5.44E+03
Use of renewable primary energy excluding renewable primary energy resources used as raw materials (PERE) (net cal. value) [MJ]	2.85E+01
Use of renewable primary energy resources used as raw materials (PERM) (net cal. value) [MJ]	0.00E+00
Total use of renewable primary energy resources (PERT) (net cal. value) [MJ]	2.85E+01
Use of non- renewable primary energy excluding non- renewable primary energy resources used as raw materials (PENRE) (net cal. value) [MJ]	5.45E+03
Use of non- renewable primary energy resources used as raw Materials (PENRM) (net cal. value) [MJ]	0.00E+00
Total use of non- renewable primary energy resources (PENRT) (net cal. value) [MJ]	5.45E+03
Use of secondary material [kg]	3.12E+02
Use of renewable secondary fuels (net cal. value) [MJ]	0.00E+00
Use of non- renewable secondary fuels (net cal. value) [MJ]	3.90E+01
Use of net fresh water [m ³]	6.50E-01
Hazardous waste disposed [kg]	1.07E-03
Non-hazardous waste disposed [kg]	1.00E-01
Radioactive waste disposed/stored [kg]	0.00E+00
Components for re-use [kg]	0.00E+00
Materials for recycling [kg]	0.00E+00
Materials for energy recovery [kg]	0.00E+00
Exported energy [MJ]	0.00E+00
Electricity use [kWh]	8.31E+01
Dust [kg]	1.60E-01

7.5 LCIA of cement products for Gagal-1 plant

7.5.1 Gagal-1 - ACC Concrete+ Xtra Strong Cement

LCIA	A1-A3
Global Warming Potential (GWP 100 years) [kg CO ₂ -Equiv.]	7.32E+02
Ozone Layer Depletion Potential (ODP, steady state) [kg CFC11-Equiv.]	4.34E-10
Acidification Potential (AP) [kg SO ₂ -Equiv.]	2.80E+00
Eutrophication Potential (EP) [kg Phosphate-Equiv.]	5.20E-01
Photochemical Ozone Creation Potential (POCP) [kg Ethene-Equiv.]	1.60E-01
Abiotic Depletion Potential (ADP elements) [kg Sb-Equiv.]	7.56E-04
Abiotic Depletion Potential (ADP-fossil fuels) (net cal. value) [MJ]	2.89E+03
Use of renewable primary energy excluding renewable primary energy resources used as raw materials (PERE) (net cal. value) [MJ]	6.63E+01
Use of renewable primary energy resources used as raw materials (PERM) (net cal. value) [MJ]	0.00E+00
Total use of renewable primary energy resources (PERT) (net cal. value) [MJ]	6.63E+01
Use of non- renewable primary energy excluding non- renewable primary energy resources used as raw materials (PENRE) (net cal. value) [MJ]	2.90E+03
Use of non- renewable primary energy resources used as raw Materials (PENRM) (net cal. value) [MJ]	0.00E+00
Total use of non- renewable primary energy resources (PENRT) (net cal. value) [MJ]	2.90E+03
Use of secondary material [kg]	2.99E+02
Use of renewable secondary fuels (net cal. value) [MJ]	0.00E+00
Use of non- renewable secondary fuels (net cal. value) [MJ]	6.25E+01
Use of net fresh water [m ³]	7.70E-01
Hazardous waste disposed [kg]	5.69E-04
Non-hazardous waste disposed [kg]	1.00E-01
Radioactive waste disposed/stored [kg]	0.00E+00
Components for re-use [kg]	0.00E+00
Materials for recycling [kg]	0.00E+00
Materials for energy recovery [kg]	0.00E+00
Exported energy [MJ]	0.00E+00
Electricity use [kWh]	6.20E+01
Dust [kg]	2.00E-02

7.5.2 Gagal-1 - ACC Gold Water Shield Cement

LCIA	A1-A3
Global Warming Potential (GWP 100 years) [kg CO ₂ -Equiv.]	6.81E+02
Ozone Layer Depletion Potential (ODP, steady state) [kg CFC11-Equiv.]	4.20E-10
Acidification Potential (AP) [kg SO ₂ -Equiv.]	2.62E+00
Eutrophication Potential (EP) [kg Phosphate-Equiv.]	4.80E-01
Photochemical Ozone Creation Potential (POCP) [kg Ethene-Equiv.]	1.50E-01
Abiotic Depletion Potential (ADP elements) [kg Sb-Equiv.]	7.55E-04
Abiotic Depletion Potential (ADP-fossil fuels) (net cal. value) [MJ]	2.71E+03
Use of renewable primary energy excluding renewable primary energy resources used as raw materials (PERE) (net cal. value) [MJ]	6.43E+01
Use of renewable primary energy resources used as raw materials (PERM) (net cal. value) [MJ]	0.00E+00
Total use of renewable primary energy resources (PERT) (net cal. value) [MJ]	6.43E+01
Use of non- renewable primary energy excluding non- renewable primary energy resources used as raw materials (PENRE) (net cal. value) [MJ]	2.72E+03
Use of non- renewable primary energy resources used as raw Materials (PENRM) (net cal. value) [MJ]	0.00E+00
Total use of non- renewable primary energy resources (PENRT) (net cal. value) [MJ]	2.72E+03
Use of secondary material [kg]	3.52E+02
Use of renewable secondary fuels (net cal. value) [MJ]	0.00E+00
Use of non- renewable secondary fuels (net cal. value) [MJ]	5.78E+01
Use of net fresh water [m ³]	7.40E-01
Hazardous waste disposed [kg]	5.66E-04
Non-hazardous waste disposed [kg]	1.00E-01
Radioactive waste disposed/stored [kg]	0.00E+00
Components for re-use [kg]	0.00E+00
Materials for recycling [kg]	0.00E+00
Materials for energy recovery [kg]	0.00E+00
Exported energy [MJ]	0.00E+00
Electricity use [kWh]	6.01E+01
Dust [kg]	2.00E-02

7.5.3 Gagal-1 - ACC Suraksha Power Cement

LCIA	A1-A3
Global Warming Potential (GWP 100 years) [kg CO ₂ -Equiv.]	6.61E+02
Ozone Layer Depletion Potential (ODP, steady state) [kg CFC11-Equiv.]	4.13E-10
Acidification Potential (AP) [kg SO ₂ -Equiv.]	2.55E+00
Eutrophication Potential (EP) [kg Phosphate-Equiv.]	4.60E-01
Photochemical Ozone Creation Potential (POCP) [kg Ethene-Equiv.]	1.40E-01
Abiotic Depletion Potential (ADP elements) [kg Sb-Equiv.]	7.55E-04
Abiotic Depletion Potential (ADP-fossil fuels) (net cal. value) [MJ]	2.64E+03
Use of renewable primary energy excluding renewable primary energy resources used as raw materials (PERE) (net cal. value) [MJ]	6.34E+01
Use of renewable primary energy resources used as raw materials (PERM) (net cal. value) [MJ]	0.00E+00
Total use of renewable primary energy resources (PERT) (net cal. value) [MJ]	6.34E+01
Use of non- renewable primary energy excluding non- renewable primary energy resources used as raw materials (PENRE) (net cal. value) [MJ]	2.65E+03
Use of non- renewable primary energy resources used as raw Materials (PENRM) (net cal. value) [MJ]	0.00E+00
Total use of non- renewable primary energy resources (PENRT) (net cal. value) [MJ]	2.65E+03
Use of secondary material [kg]	3.73E+02
Use of renewable secondary fuels (net cal. value) [MJ]	0.00E+00
Use of non- renewable secondary fuels (net cal. value) [MJ]	5.60E+01
Use of net fresh water [m ³]	7.30E-01
Hazardous waste disposed [kg]	5.64E-04
Non-hazardous waste disposed [kg]	9.00E-02
Radioactive waste disposed/stored [kg]	0.00E+00
Components for re-use [kg]	0.00E+00
Materials for recycling [kg]	0.00E+00
Materials for energy recovery [kg]	0.00E+00
Exported energy [MJ]	0.00E+00
Electricity use [kWh]	5.93E+01
Dust [kg]	2.00E-02

7.6 LCIA of cement product for Gagal-2 plant

7.6.1 Gagal-2 - ACC Suraksha Power Cement

LCIA	A1-A3
Global Warming Potential (GWP 100 years) [kg CO ₂ -Equiv.]	6.75E+02
Ozone Layer Depletion Potential (ODP, steady state) [kg CFC11-Equiv.]	4.08E-10
Acidification Potential (AP) [kg SO ₂ -Equiv.]	1.81E+00
Eutrophication Potential (EP) [kg Phosphate-Equiv.]	2.90E-01
Photochemical Ozone Creation Potential (POCP) [kg Ethene-Equiv.]	1.10E-01
Abiotic Depletion Potential (ADP elements) [kg Sb-Equiv.]	7.55E-04
Abiotic Depletion Potential (ADP-fossil fuels) (net cal. value) [MJ]	2.71E+03
Use of renewable primary energy excluding renewable primary energy resources used as raw materials (PERE) (net cal. value) [MJ]	6.08E+01
Use of renewable primary energy resources used as raw materials (PERM) (net cal. value) [MJ]	0.00E+00
Total use of renewable primary energy resources (PERT) (net cal. value) [MJ]	6.08E+01
Use of non- renewable primary energy excluding non- renewable primary energy resources used as raw materials (PENRE) (net cal. value) [MJ]	2.72E+03
Use of non- renewable primary energy resources used as raw Materials (PENRM) (net cal. value) [MJ]	0.00E+00
Total use of non- renewable primary energy resources (PENRT) (net cal. value) [MJ]	2.72E+03
Use of secondary material [kg]	3.36E+02
Use of renewable secondary fuels (net cal. value) [MJ]	0.00E+00
Use of non- renewable secondary fuels (net cal. value) [MJ]	5.02E+01
Use of net fresh water [m ³]	6.30E-01
Hazardous waste disposed [kg]	4.53E-04
Non-hazardous waste disposed [kg]	9.00E-02
Radioactive waste disposed/stored [kg]	0.00E+00
Components for re-use [kg]	0.00E+00
Materials for recycling [kg]	0.00E+00
Materials for energy recovery [kg]	0.00E+00
Exported energy [MJ]	0.00E+00
Electricity use [kWh]	5.53E+01
Dust [kg]	4.00E-02

7.7 LCIA of cement products for Jamul plant

7.7.1 Jamul - ACC F2R Superfast Cement

LCIA	A1-A3
Global Warming Potential (GWP 100 years) [kg CO ₂ -Equiv.]	6.33E+02
Ozone Layer Depletion Potential (ODP, steady state) [kg CFC11-Equiv.]	3.31E-10
Acidification Potential (AP) [kg SO ₂ -Equiv.]	2.65E+00
Eutrophication Potential (EP) [kg Phosphate-Equiv.]	2.20E-01
Photochemical Ozone Creation Potential (POCP) [kg Ethene-Equiv.]	1.40E-01
Abiotic Depletion Potential (ADP elements) [kg Sb-Equiv.]	7.55E-04
Abiotic Depletion Potential (ADP-fossil fuels) (net cal. value) [MJ]	3.46E+03
Use of renewable primary energy excluding renewable primary energy resources used as raw materials (PERE) (net cal. value) [MJ]	3.97E+01
Use of renewable primary energy resources used as raw materials (PERM) (net cal. value) [MJ]	0.00E+00
Total use of renewable primary energy resources (PERT) (net cal. value) [MJ]	3.97E+01
Use of non- renewable primary energy excluding non- renewable primary energy resources used as raw materials (PENRE) (net cal. value) [MJ]	3.46E+03
Use of non- renewable primary energy resources used as raw Materials (PENRM) (net cal. value) [MJ]	0.00E+00
Total use of non- renewable primary energy resources (PENRT) (net cal. value) [MJ]	3.46E+03
Use of secondary material [kg]	4.57E+02
Use of renewable secondary fuels (net cal. value) [MJ]	0.00E+00
Use of non- renewable secondary fuels (net cal. value) [MJ]	0.00E+00
Use of net fresh water [m ³]	2.40E-01
Hazardous waste disposed [kg]	6.70E-04
Non-hazardous waste disposed [kg]	7.00E-02
Radioactive waste disposed/stored [kg]	0.00E+00
Components for re-use [kg]	0.00E+00
Materials for recycling [kg]	0.00E+00
Materials for energy recovery [kg]	0.00E+00
Exported energy [MJ]	0.00E+00
Electricity use [kWh]	7.14E+01
Dust [kg]	1.00E-02

7.7.2 Jamul - ACC HPC Long Life Cement

LCIA	A1-A3
Global Warming Potential (GWP 100 years) [kg CO ₂ -Equiv.]	5.50E+02
Ozone Layer Depletion Potential (ODP, steady state) [kg CFC11-Equiv.]	3.10E-10
Acidification Potential (AP) [kg SO ₂ -Equiv.]	2.47E+00
Eutrophication Potential (EP) [kg Phosphate-Equiv.]	2.00E-01
Photochemical Ozone Creation Potential (POCP) [kg Ethene-Equiv.]	1.30E-01
Abiotic Depletion Potential (ADP elements) [kg Sb-Equiv.]	7.55E-04
Abiotic Depletion Potential (ADP-fossil fuels) (net cal. value) [MJ]	3.12E+03
Use of renewable primary energy excluding renewable primary energy resources used as raw materials (PERE) (net cal. value) [MJ]	3.77E+01
Use of renewable primary energy resources used as raw materials (PERM) (net cal. value) [MJ]	0.00E+00
Total use of renewable primary energy resources (PERT) (net cal. value) [MJ]	3.77E+01
Use of non- renewable primary energy excluding non- renewable primary energy resources used as raw materials (PENRE) (net cal. value) [MJ]	3.12E+03
Use of non- renewable primary energy resources used as raw Materials (PENRM) (net cal. value) [MJ]	0.00E+00
Total use of non- renewable primary energy resources (PENRT) (net cal. value) [MJ]	3.12E+03
Use of secondary material [kg]	5.36E+02
Use of renewable secondary fuels (net cal. value) [MJ]	0.00E+00
Use of non- renewable secondary fuels (net cal. value) [MJ]	0.00E+00
Use of net fresh water [m ³]	2.30E-01
Hazardous waste disposed [kg]	6.65E-04
Non-hazardous waste disposed [kg]	7.00E-02
Radioactive waste disposed/stored [kg]	0.00E+00
Components for re-use [kg]	0.00E+00
Materials for recycling [kg]	0.00E+00
Materials for energy recovery [kg]	0.00E+00
Exported energy [MJ]	0.00E+00
Electricity use [kWh]	6.83E+01
Dust [kg]	1.00E-02

7.8 LCIA of cement products for Kymore plant

7.8.1 Kymore - ACC Gold Water Shield Cement

LCIA	A1-A3
Global Warming Potential (GWP 100 years) [kg CO ₂ -Equiv.]	6.86E+02
Ozone Layer Depletion Potential (ODP, steady state) [kg CFC11-Equiv.]	7.51E-10
Acidification Potential (AP) [kg SO ₂ -Equiv.]	1.21E+00
Eutrophication Potential (EP) [kg Phosphate-Equiv.]	2.00E-01
Photochemical Ozone Creation Potential (POCP) [kg Ethene-Equiv.]	7.00E-02
Abiotic Depletion Potential (ADP elements) [kg Sb-Equiv.]	7.58E-04
Abiotic Depletion Potential (ADP-fossil fuels) (net cal. value) [MJ]	4.66E+03
Use of renewable primary energy excluding renewable primary energy resources used as raw materials (PERE) (net cal. value) [MJ]	2.94E+01
Use of renewable primary energy resources used as raw materials (PERM) (net cal. value) [MJ]	0.00E+00
Total use of renewable primary energy resources (PERT) (net cal. value) [MJ]	2.94E+01
Use of non- renewable primary energy excluding non- renewable primary energy resources used as raw materials (PENRE) (net cal. value) [MJ]	4.67E+03
Use of non- renewable primary energy resources used as raw Materials (PENRM) (net cal. value) [MJ]	0.00E+00
Total use of non- renewable primary energy resources (PENRT) (net cal. value) [MJ]	4.67E+03
Use of secondary material [kg]	4.22E+02
Use of renewable secondary fuels (net cal. value) [MJ]	5.22E+01
Use of non- renewable secondary fuels (net cal. value) [MJ]	9.35E+01
Use of net fresh water [m ³]	2.80E-01
Hazardous waste disposed [kg]	3.85E-03
Non-hazardous waste disposed [kg]	3.10E-01
Radioactive waste disposed/stored [kg]	0.00E+00
Components for re-use [kg]	0.00E+00
Materials for recycling [kg]	0.00E+00
Materials for energy recovery [kg]	0.00E+00
Exported energy [MJ]	0.00E+00
Electricity use [kWh]	6.14E+01
Dust [kg]	5.00E-02

7.8.2 Kymore - ACC Suraksha Power Cement

LCIA	A1-A3
Global Warming Potential (GWP 100 years) [kg CO ₂ -Equiv.]	6.89E+02
Ozone Layer Depletion Potential (ODP, steady state) [kg CFC11-Equiv.]	7.52E-10
Acidification Potential (AP) [kg SO ₂ -Equiv.]	1.21E+00
Eutrophication Potential (EP) [kg Phosphate-Equiv.]	2.00E-01
Photochemical Ozone Creation Potential (POCP) [kg Ethene-Equiv.]	7.00E-02
Abiotic Depletion Potential (ADP elements) [kg Sb-Equiv.]	7.58E-04
Abiotic Depletion Potential (ADP-fossil fuels) (net cal. value) [MJ]	4.67E+03
Use of renewable primary energy excluding renewable primary energy resources used as raw materials (PERE) (net cal. value) [MJ]	2.94E+01
Use of renewable primary energy resources used as raw materials (PERM) (net cal. value) [MJ]	0.00E+00
Total use of renewable primary energy resources (PERT) (net cal. value) [MJ]	2.94E+01
Use of non- renewable primary energy excluding non- renewable primary energy resources used as raw materials (PENRE) (net cal. value) [MJ]	4.68E+03
Use of non- renewable primary energy resources used as raw Materials (PENRM) (net cal. value) [MJ]	0.00E+00
Total use of non- renewable primary energy resources (PENRT) (net cal. value) [MJ]	4.68E+03
Use of secondary material [kg]	4.20E+02
Use of renewable secondary fuels (net cal. value) [MJ]	5.24E+01
Use of non- renewable secondary fuels (net cal. value) [MJ]	9.39E+01
Use of net fresh water [m ³]	2.80E-01
Hazardous waste disposed [kg]	3.85E-03
Non-hazardous waste disposed [kg]	3.10E-01
Radioactive waste disposed/stored [kg]	0.00E+00
Components for re-use [kg]	0.00E+00
Materials for recycling [kg]	0.00E+00
Materials for energy recovery [kg]	0.00E+00
Exported energy [MJ]	0.00E+00
Electricity use [kWh]	6.15E+01
Dust [kg]	5.00E-02

7.9 LCIA of cement products for Lakheri plant

7.9.1 Lakheri - ACC Concrete+ Xtra Strong Cement

LCIA	A1-A3
Global Warming Potential (GWP 100 years) [kg CO ₂ -Equiv.]	8.44E+02
Ozone Layer Depletion Potential (ODP, steady state) [kg CFC11-Equiv.]	1.09E-09
Acidification Potential (AP) [kg SO ₂ -Equiv.]	2.43E+00
Eutrophication Potential (EP) [kg Phosphate-Equiv.]	4.10E-01
Photochemical Ozone Creation Potential (POCP) [kg Ethene-Equiv.]	1.20E-01
Abiotic Depletion Potential (ADP elements) [kg Sb-Equiv.]	7.59E-04
Abiotic Depletion Potential (ADP-fossil fuels) (net cal. value) [MJ]	4.78E+03
Use of renewable primary energy excluding renewable primary energy resources used as raw materials (PERE) (net cal. value) [MJ]	2.42E+01
Use of renewable primary energy resources used as raw materials (PERM) (net cal. value) [MJ]	0.00E+00
Total use of renewable primary energy resources (PERT) (net cal. value) [MJ]	2.42E+01
Use of non- renewable primary energy excluding non- renewable primary energy resources used as raw materials (PENRE) (net cal. value) [MJ]	4.79E+03
Use of non- renewable primary energy resources used as raw Materials (PENRM) (net cal. value) [MJ]	0.00E+00
Total use of non- renewable primary energy resources (PENRT) (net cal. value) [MJ]	4.79E+03
Use of secondary material [kg]	3.30E+02
Use of renewable secondary fuels (net cal. value) [MJ]	1.77E+00
Use of non- renewable secondary fuels (net cal. value) [MJ]	3.74E+01
Use of net fresh water [m ³]	2.80E-01
Hazardous waste disposed [kg]	6.97E-03
Non-hazardous waste disposed [kg]	1.00E-01
Radioactive waste disposed/stored [kg]	0.00E+00
Components for re-use [kg]	0.00E+00
Materials for recycling [kg]	0.00E+00
Materials for energy recovery [kg]	0.00E+00
Exported energy [MJ]	0.00E+00
Electricity use [kWh]	6.33E+01
Dust [kg]	4.00E-02

7.9.2 Lakheri - ACC Suraksha Power Cement

LCIA	A1-A3
Global Warming Potential (GWP 100 years) [kg CO ₂ -Equiv.]	7.75E+02
Ozone Layer Depletion Potential (ODP, steady state) [kg CFC11-Equiv.]	1.07E-09
Acidification Potential (AP) [kg SO ₂ -Equiv.]	2.25E+00
Eutrophication Potential (EP) [kg Phosphate-Equiv.]	3.80E-01
Photochemical Ozone Creation Potential (POCP) [kg Ethene-Equiv.]	1.10E-01
Abiotic Depletion Potential (ADP elements) [kg Sb-Equiv.]	7.59E-04
Abiotic Depletion Potential (ADP-fossil fuels) (net cal. value) [MJ]	4.48E+03
Use of renewable primary energy excluding renewable primary energy resources used as raw materials (PERE) (net cal. value) [MJ]	2.33E+01
Use of renewable primary energy resources used as raw materials (PERM) (net cal. value) [MJ]	0.00E+00
Total use of renewable primary energy resources (PERT) (net cal. value) [MJ]	2.33E+01
Use of non- renewable primary energy excluding non- renewable primary energy resources used as raw materials (PENRE) (net cal. value) [MJ]	4.49E+03
Use of non- renewable primary energy resources used as raw Materials (PENRM) (net cal. value) [MJ]	0.00E+00
Total use of non- renewable primary energy resources (PENRT) (net cal. value) [MJ]	4.49E+03
Use of secondary material [kg]	3.92E+02
Use of renewable secondary fuels (net cal. value) [MJ]	1.61E+00
Use of non- renewable secondary fuels (net cal. value) [MJ]	3.40E+01
Use of net fresh water [m ³]	2.70E-01
Hazardous waste disposed [kg]	6.96E-03
Non-hazardous waste disposed [kg]	9.00E-02
Radioactive waste disposed/stored [kg]	0.00E+00
Components for re-use [kg]	0.00E+00
Materials for recycling [kg]	0.00E+00
Materials for energy recovery [kg]	0.00E+00
Exported energy [MJ]	0.00E+00
Electricity use [kWh]	6.09E+01
Dust [kg]	4.00E-02

7.10 LCIA of cement products for Madukkarai plant

7.10.1 Madukkarai - ACC F2R Superfast Cement

LCIA	A1-A3
Global Warming Potential (GWP 100 years) [kg CO ₂ -Equiv.]	9.30E+02
Ozone Layer Depletion Potential (ODP, steady state) [kg CFC11-Equiv.]	6.19E-10
Acidification Potential (AP) [kg SO ₂ -Equiv.]	2.80E+00
Eutrophication Potential (EP) [kg Phosphate-Equiv.]	4.90E-01
Photochemical Ozone Creation Potential (POCP) [kg Ethene-Equiv.]	1.60E-01
Abiotic Depletion Potential (ADP elements) [kg Sb-Equiv.]	7.56E-04
Abiotic Depletion Potential (ADP-fossil fuels) (net cal. value) [MJ]	5.61E+03
Use of renewable primary energy excluding renewable primary energy resources used as raw materials (PERE) (net cal. value) [MJ]	2.53E+01
Use of renewable primary energy resources used as raw materials (PERM) (net cal. value) [MJ]	0.00E+00
Total use of renewable primary energy resources (PERT) (net cal. value) [MJ]	2.53E+01
Use of non- renewable primary energy excluding non- renewable primary energy resources used as raw materials (PENRE) (net cal. value) [MJ]	5.62E+03
Use of non- renewable primary energy resources used as raw Materials (PENRM) (net cal. value) [MJ]	0.00E+00
Total use of non- renewable primary energy resources (PENRT) (net cal. value) [MJ]	5.62E+03
Use of secondary material [kg]	4.43E+02
Use of renewable secondary fuels (net cal. value) [MJ]	2.22E+01
Use of non- renewable secondary fuels (net cal. value) [MJ]	1.43E+02
Use of net fresh water [m ³]	4.30E-01
Hazardous waste disposed [kg]	2.30E-03
Non-hazardous waste disposed [kg]	1.00E-01
Radioactive waste disposed/stored [kg]	0.00E+00
Components for re-use [kg]	0.00E+00
Materials for recycling [kg]	0.00E+00
Materials for energy recovery [kg]	0.00E+00
Exported energy [MJ]	0.00E+00
Electricity use [kWh]	9.37E+01
Dust [kg]	2.00E-02

7.10.2 Madukkarai - ACC Suraksha Power Cement

LCIA	A1-A3
Global Warming Potential (GWP 100 years) [kg CO ₂ -Equiv.]	1.11E+03
Ozone Layer Depletion Potential (ODP, steady state) [kg CFC11-Equiv.]	6.66E-10
Acidification Potential (AP) [kg SO ₂ -Equiv.]	3.25E+00
Eutrophication Potential (EP) [kg Phosphate-Equiv.]	5.70E-01
Photochemical Ozone Creation Potential (POCP) [kg Ethene-Equiv.]	2.00E-01
Abiotic Depletion Potential (ADP elements) [kg Sb-Equiv.]	7.57E-04
Abiotic Depletion Potential (ADP-fossil fuels) (net cal. value) [MJ]	6.39E+03
Use of renewable primary energy excluding renewable primary energy resources used as raw materials (PERE) (net cal. value) [MJ]	2.75E+01
Use of renewable primary energy resources used as raw materials (PERM) (net cal. value) [MJ]	0.00E+00
Total use of renewable primary energy resources (PERT) (net cal. value) [MJ]	2.75E+01
Use of non- renewable primary energy excluding non- renewable primary energy resources used as raw materials (PENRE) (net cal. value) [MJ]	6.40E+03
Use of non- renewable primary energy resources used as raw Materials (PENRM) (net cal. value) [MJ]	0.00E+00
Total use of non- renewable primary energy resources (PENRT) (net cal. value) [MJ]	6.40E+03
Use of secondary material [kg]	3.12E+02
Use of renewable secondary fuels (net cal. value) [MJ]	2.75E+01
Use of non- renewable secondary fuels (net cal. value) [MJ]	1.62E+02
Use of net fresh water [m ³]	4.50E-01
Hazardous waste disposed [kg]	2.32E-03
Non-hazardous waste disposed [kg]	1.10E-01
Radioactive waste disposed/stored [kg]	0.00E+00
Components for re-use [kg]	0.00E+00
Materials for recycling [kg]	0.00E+00
Materials for energy recovery [kg]	0.00E+00
Exported energy [MJ]	0.00E+00
Electricity use [kWh]	1.04E+02
Dust [kg]	3.00E-02

7.11 LCIA of cement products for Wadi-1 plant

7.11.1 Wadi-1 - ACC HPC Long Life Cement

LCIA	A1-A3
Global Warming Potential (GWP 100 years) [kg CO ₂ -Equiv.]	6.79E+02
Ozone Layer Depletion Potential (ODP, steady state) [kg CFC11-Equiv.]	3.05E-10
Acidification Potential (AP) [kg SO ₂ -Equiv.]	7.70E-01
Eutrophication Potential (EP) [kg Phosphate-Equiv.]	1.00E-01
Photochemical Ozone Creation Potential (POCP) [kg Ethene-Equiv.]	6.00E-02
Abiotic Depletion Potential (ADP elements) [kg Sb-Equiv.]	7.56E-04
Abiotic Depletion Potential (ADP-fossil fuels) (net cal. value) [MJ]	4.26E+03
Use of renewable primary energy excluding renewable primary energy resources used as raw materials (PERE) (net cal. value) [MJ]	2.16E+01
Use of renewable primary energy resources used as raw materials (PERM) (net cal. value) [MJ]	0.00E+00
Total use of renewable primary energy resources (PERT) (net cal. value) [MJ]	2.16E+01
Use of non- renewable primary energy excluding non- renewable primary energy resources used as raw materials (PENRE) (net cal. value) [MJ]	4.27E+03
Use of non- renewable primary energy resources used as raw Materials (PENRM) (net cal. value) [MJ]	0.00E+00
Total use of non- renewable primary energy resources (PENRT) (net cal. value) [MJ]	4.27E+03
Use of secondary material [kg]	4.92E+02
Use of renewable secondary fuels (net cal. value) [MJ]	0.00E+00
Use of non- renewable secondary fuels (net cal. value) [MJ]	2.72E+01
Use of net fresh water [m ³]	1.70E-01
Hazardous waste disposed [kg]	1.89E-04
Non-hazardous waste disposed [kg]	7.00E-02
Radioactive waste disposed/stored [kg]	0.00E+00
Components for re-use [kg]	0.00E+00
Materials for recycling [kg]	0.00E+00
Materials for energy recovery [kg]	0.00E+00
Exported energy [MJ]	0.00E+00
Electricity use [kWh]	7.91E+01
Dust [kg]	3.68E-03

7.11.2 Wadi-1 - ACC Concrete+ Xtra Strong Cement

LCIA	A1-A3
Global Warming Potential (GWP 100 years) [kg CO ₂ -Equiv.]	8.90E+02
Ozone Layer Depletion Potential (ODP, steady state) [kg CFC11-Equiv.]	3.71E-10
Acidification Potential (AP) [kg SO ₂ -Equiv.]	9.90E-01
Eutrophication Potential (EP) [kg Phosphate-Equiv.]	1.30E-01
Photochemical Ozone Creation Potential (POCP) [kg Ethene-Equiv.]	8.00E-02
Abiotic Depletion Potential (ADP elements) [kg Sb-Equiv.]	7.57E-04
Abiotic Depletion Potential (ADP-fossil fuels) (net cal. value) [MJ]	5.32E+03
Use of renewable primary energy excluding renewable primary energy resources used as raw materials (PERE) (net cal. value) [MJ]	2.52E+01
Use of renewable primary energy resources used as raw materials (PERM) (net cal. value) [MJ]	0.00E+00
Total use of renewable primary energy resources (PERT) (net cal. value) [MJ]	2.52E+01
Use of non- renewable primary energy excluding non- renewable primary energy resources used as raw materials (PENRE) (net cal. value) [MJ]	5.33E+03
Use of non- renewable primary energy resources used as raw Materials (PENRM) (net cal. value) [MJ]	0.00E+00
Total use of non- renewable primary energy resources (PENRT) (net cal. value) [MJ]	5.33E+03
Use of secondary material [kg]	3.08E+02
Use of renewable secondary fuels (net cal. value) [MJ]	0.00E+00
Use of non- renewable secondary fuels (net cal. value) [MJ]	3.69E+01
Use of net fresh water [m ³]	2.00E-01
Hazardous waste disposed [kg]	2.04E-04
Non-hazardous waste disposed [kg]	8.00E-02
Radioactive waste disposed/stored [kg]	0.00E+00
Components for re-use [kg]	0.00E+00
Materials for recycling [kg]	0.00E+00
Materials for energy recovery [kg]	0.00E+00
Exported energy [MJ]	0.00E+00
Electricity use [kWh]	8.97E+01
Dust [kg]	5.00E-03

7.12 LCIA of cement products for Wadi-2 plant

7.12.1 Wadi-2 - ACC Suraksha Power Cement

LCIA	A1-A3
Global Warming Potential (GWP 100 years) [kg CO ₂ -Equiv.]	7.09E+02
Ozone Layer Depletion Potential (ODP, steady state) [kg CFC11-Equiv.]	4.27E-10
Acidification Potential (AP) [kg SO ₂ -Equiv.]	1.19E+00
Eutrophication Potential (EP) [kg Phosphate-Equiv.]	2.20E-01
Photochemical Ozone Creation Potential (POCP) [kg Ethene-Equiv.]	1.00E-01
Abiotic Depletion Potential (ADP elements) [kg Sb-Equiv.]	6.81E-04
Abiotic Depletion Potential (ADP-fossil fuels) (net cal. value) [MJ]	4.33E+03
Use of renewable primary energy excluding renewable primary energy resources used as raw materials (PERE) (net cal. value) [MJ]	2.40E+01
Use of renewable primary energy resources used as raw materials (PERM) (net cal. value) [MJ]	0.00E+00
Total use of renewable primary energy resources (PERT) (net cal. value) [MJ]	2.40E+01
Use of non- renewable primary energy excluding non- renewable primary energy resources used as raw materials (PENRE) (net cal. value) [MJ]	4.34E+03
Use of non- renewable primary energy resources used as raw Materials (PENRM) (net cal. value) [MJ]	0.00E+00
Total use of non- renewable primary energy resources (PENRT) (net cal. value) [MJ]	4.34E+03
Use of secondary material [kg]	4.69E+02
Use of renewable secondary fuels (net cal. value) [MJ]	1.44E+00
Use of non- renewable secondary fuels (net cal. value) [MJ]	1.24E+02
Use of net fresh water [m ³]	1.80E-01
Hazardous waste disposed [kg]	3.40E-04
Non-hazardous waste disposed [kg]	7.00E-02
Radioactive waste disposed/stored [kg]	0.00E+00
Components for re-use [kg]	0.00E+00
Materials for recycling [kg]	0.00E+00
Materials for energy recovery [kg]	0.00E+00
Exported energy [MJ]	0.00E+00
Electricity use [kWh]	7.12E+01
Dust [kg]	2.00E-02

7.12.2 Wadi-2 - ACC Concrete+ Xtra Strong Cement

LCIA	A1-A3
Global Warming Potential (GWP 100 years) [kg CO ₂ -Equiv.]	8.01E+02
Ozone Layer Depletion Potential (ODP, steady state) [kg CFC11-Equiv.]	4.80E-10
Acidification Potential (AP) [kg SO ₂ -Equiv.]	1.34E+00
Eutrophication Potential (EP) [kg Phosphate-Equiv.]	2.40E-01
Photochemical Ozone Creation Potential (POCP) [kg Ethene-Equiv.]	1.10E-01
Abiotic Depletion Potential (ADP elements) [kg Sb-Equiv.]	7.56E-04
Abiotic Depletion Potential (ADP-fossil fuels) (net cal. value) [MJ]	4.86E+03
Use of renewable primary energy excluding renewable primary energy resources used as raw materials (PERE) (net cal. value) [MJ]	2.68E+01
Use of renewable primary energy resources used as raw materials (PERM) (net cal. value) [MJ]	0.00E+00
Total use of renewable primary energy resources (PERT) (net cal. value) [MJ]	2.68E+01
Use of non- renewable primary energy excluding non- renewable primary energy resources used as raw materials (PENRE) (net cal. value) [MJ]	4.87E+03
Use of non- renewable primary energy resources used as raw Materials (PENRM) (net cal. value) [MJ]	0.00E+00
Total use of non- renewable primary energy resources (PENRT) (net cal. value) [MJ]	4.87E+03
Use of secondary material [kg]	3.78E+02
Use of renewable secondary fuels (net cal. value) [MJ]	1.63E+00
Use of non- renewable secondary fuels (net cal. value) [MJ]	1.40E+02
Use of net fresh water [m ³]	2.00E-01
Hazardous waste disposed [kg]	3.79E-04
Non-hazardous waste disposed [kg]	8.00E-02
Radioactive waste disposed/stored [kg]	0.00E+00
Components for re-use [kg]	0.00E+00
Materials for recycling [kg]	0.00E+00
Materials for energy recovery [kg]	0.00E+00
Exported energy [MJ]	0.00E+00
Electricity use [kWh]	7.52E+01
Dust [kg]	2.00E-02

7.13 LCIA of cement products for Damodhar plant

7.13.1 Damodhar - ACC HPC Long Life Cement

LCIA	A1-A3
Global Warming Potential (GWP 100 years) [kg CO ₂ -Equiv.]	5.24E+02
Ozone Layer Depletion Potential (ODP, steady state) [kg CFC11-Equiv.]	2.05E-10
Acidification Potential (AP) [kg SO ₂ -Equiv.]	1.62E+00
Eutrophication Potential (EP) [kg Phosphate-Equiv.]	1.70E-01
Photochemical Ozone Creation Potential (POCP) [kg Ethene-Equiv.]	1.00E-01
Abiotic Depletion Potential (ADP elements) [kg Sb-Equiv.]	7.55E-04
Abiotic Depletion Potential (ADP-fossil fuels) (net cal. value) [MJ]	2.17E+03
Use of renewable primary energy excluding renewable primary energy resources used as raw materials (PERE) (net cal. value) [MJ]	5.70E+01
Use of renewable primary energy resources used as raw materials (PERM) (net cal. value) [MJ]	0.00E+00
Total use of renewable primary energy resources (PERT) (net cal. value) [MJ]	5.70E+01
Use of non- renewable primary energy excluding non- renewable primary energy resources used as raw materials (PENRE) (net cal. value) [MJ]	2.18E+03
Use of non- renewable primary energy resources used as raw Materials (PENRM) (net cal. value) [MJ]	0.00E+00
Total use of non- renewable primary energy resources (PENRT) (net cal. value) [MJ]	2.18E+03
Use of secondary material [kg]	5.33E+02
Use of renewable secondary fuels (net cal. value) [MJ]	0.00E+00
Use of non- renewable secondary fuels (net cal. value) [MJ]	0.00E+00
Use of net fresh water [m ³]	3.60E-01
Hazardous waste disposed [kg]	4.69E-05
Non-hazardous waste disposed [kg]	5.00E-02
Radioactive waste disposed/stored [kg]	0.00E+00
Components for re-use [kg]	0.00E+00
Materials for recycling [kg]	0.00E+00
Materials for energy recovery [kg]	0.00E+00
Exported energy [MJ]	0.00E+00
Electricity use [kWh]	6.85E+01
Dust [kg]	2.47E-03

7.13.2 Damodhar - ACC F2R Superfast Cement

LCIA	A1-A3
Global Warming Potential (GWP 100 years) [kg CO ₂ -Equiv.]	6.46E+02
Ozone Layer Depletion Potential (ODP, steady state) [kg CFC11-Equiv.]	2.37E-10
Acidification Potential (AP) [kg SO ₂ -Equiv.]	1.90E+00
Eutrophication Potential (EP) [kg Phosphate-Equiv.]	2.10E-01
Photochemical Ozone Creation Potential (POCP) [kg Ethene-Equiv.]	1.10E-01
Abiotic Depletion Potential (ADP elements) [kg Sb-Equiv.]	7.55E-04
Abiotic Depletion Potential (ADP-fossil fuels) (net cal. value) [MJ]	2.70E+03
Use of renewable primary energy excluding renewable primary energy resources used as raw materials (PERE) (net cal. value) [MJ]	5.99E+01
Use of renewable primary energy resources used as raw materials (PERM) (net cal. value) [MJ]	0.00E+00
Total use of renewable primary energy resources (PERT) (net cal. value) [MJ]	5.99E+01
Use of non- renewable primary energy excluding non- renewable primary energy resources used as raw materials (PENRE) (net cal. value) [MJ]	2.70E+03
Use of non- renewable primary energy resources used as raw Materials (PENRM) (net cal. value) [MJ]	0.00E+00
Total use of non- renewable primary energy resources (PENRT) (net cal. value) [MJ]	2.70E+03
Use of secondary material [kg]	4.20E+02
Use of renewable secondary fuels (net cal. value) [MJ]	0.00E+00
Use of non- renewable secondary fuels (net cal. value) [MJ]	0.00E+00
Use of net fresh water [m ³]	3.80E-01
Hazardous waste disposed [kg]	5.46E-05
Non-hazardous waste disposed [kg]	5.00E-02
Radioactive waste disposed/stored [kg]	0.00E+00
Components for re-use [kg]	0.00E+00
Materials for recycling [kg]	0.00E+00
Materials for energy recovery [kg]	0.00E+00
Exported energy [MJ]	0.00E+00
Electricity use [kWh]	7.30E+01
Dust [kg]	3.12E-03

7.13.3 Damodhar - ACC Suraksha Power Cement

LCIA	A1-A3
Global Warming Potential (GWP 100 years) [kg CO ₂ -Equiv.]	8.48E+02
Ozone Layer Depletion Potential (ODP, steady state) [kg CFC11-Equiv.]	2.90E-10
Acidification Potential (AP) [kg SO ₂ -Equiv.]	2.37E+00
Eutrophication Potential (EP) [kg Phosphate-Equiv.]	2.70E-01
Photochemical Ozone Creation Potential (POCP) [kg Ethene-Equiv.]	1.40E-01
Abiotic Depletion Potential (ADP elements) [kg Sb-Equiv.]	7.56E-04
Abiotic Depletion Potential (ADP-fossil fuels) (net cal. value) [MJ]	3.56E+03
Use of renewable primary energy excluding renewable primary energy resources used as raw materials (PERE) (net cal. value) [MJ]	6.46E+01
Use of renewable primary energy resources used as raw materials (PERM) (net cal. value) [MJ]	0.00E+00
Total use of renewable primary energy resources (PERT) (net cal. value) [MJ]	6.46E+01
Use of non- renewable primary energy excluding non- renewable primary energy resources used as raw materials (PENRE) (net cal. value) [MJ]	3.57E+03
Use of non- renewable primary energy resources used as raw Materials (PENRM) (net cal. value) [MJ]	0.00E+00
Total use of non- renewable primary energy resources (PENRT) (net cal. value) [MJ]	3.57E+03
Use of secondary material [kg]	2.34E+02
Use of renewable secondary fuels (net cal. value) [MJ]	0.00E+00
Use of non- renewable secondary fuels (net cal. value) [MJ]	0.00E+00
Use of net fresh water [m ³]	4.10E-01
Hazardous waste disposed [kg]	6.73E-05
Non-hazardous waste disposed [kg]	6.00E-02
Radioactive waste disposed/stored [kg]	0.00E+00
Components for re-use [kg]	0.00E+00
Materials for recycling [kg]	0.00E+00
Materials for energy recovery [kg]	0.00E+00
Exported energy [MJ]	0.00E+00
Electricity use [kWh]	8.04E+01
Dust [kg]	4.19E-03

7.14 LCIA of cement products for Sindri plant

7.14.1 Sindri - ACC HPC Long Life Cement

LCIA	A1-A3
Global Warming Potential (GWP 100 years) [kg CO ₂ -Equiv.]	4.67E+02
Ozone Layer Depletion Potential (ODP, steady state) [kg CFC11-Equiv.]	7.84E-10
Acidification Potential (AP) [kg SO ₂ -Equiv.]	1.46E+00
Eutrophication Potential (EP) [kg Phosphate-Equiv.]	1.70E-01
Photochemical Ozone Creation Potential (POCP) [kg Ethene-Equiv.]	9.00E-02
Abiotic Depletion Potential (ADP elements) [kg Sb-Equiv.]	7.57E-04
Abiotic Depletion Potential (ADP-fossil fuels) (net cal. value) [MJ]	2.24E+03
Use of renewable primary energy excluding renewable primary energy resources used as raw materials (PERE) (net cal. value) [MJ]	5.42E+01
Use of renewable primary energy resources used as raw materials (PERM) (net cal. value) [MJ]	0.00E+00
Total use of renewable primary energy resources (PERT) (net cal. value) [MJ]	5.42E+01
Use of non- renewable primary energy excluding non- renewable primary energy resources used as raw materials (PENRE) (net cal. value) [MJ]	2.24E+03
Use of non- renewable primary energy resources used as raw Materials (PENRM) (net cal. value) [MJ]	0.00E+00
Total use of non- renewable primary energy resources (PENRT) (net cal. value) [MJ]	2.24E+03
Use of secondary material [kg]	5.86E+02
Use of renewable secondary fuels (net cal. value) [MJ]	8.11E+00
Use of non- renewable secondary fuels (net cal. value) [MJ]	1.56E+01
Use of net fresh water [m ³]	3.40E-01
Hazardous waste disposed [kg]	5.93E-03
Non-hazardous waste disposed [kg]	1.00E-01
Radioactive waste disposed/stored [kg]	0.00E+00
Components for re-use [kg]	0.00E+00
Materials for recycling [kg]	0.00E+00
Materials for energy recovery [kg]	0.00E+00
Exported energy [MJ]	0.00E+00
Electricity use [kWh]	6.11E+01
Dust [kg]	1.24E-02

7.14.2 Sindri - ACC F2R Superfast Cement

LCIA	A1-A3
Global Warming Potential (GWP 100 years) [kg CO ₂ -Equiv.]	6.16E+02
Ozone Layer Depletion Potential (ODP, steady state) [kg CFC11-Equiv.]	8.30E-10
Acidification Potential (AP) [kg SO ₂ -Equiv.]	1.80E+00
Eutrophication Potential (EP) [kg Phosphate-Equiv.]	2.20E-01
Photochemical Ozone Creation Potential (POCP) [kg Ethene-Equiv.]	1.10E-01
Abiotic Depletion Potential (ADP elements) [kg Sb-Equiv.]	7.58E-04
Abiotic Depletion Potential (ADP-fossil fuels) (net cal. value) [MJ]	2.94E+03
Use of renewable primary energy excluding renewable primary energy resources used as raw materials (PERE) (net cal. value) [MJ]	5.77E+01
Use of renewable primary energy resources used as raw materials (PERM) (net cal. value) [MJ]	0.00E+00
Total use of renewable primary energy resources (PERT) (net cal. value) [MJ]	5.77E+01
Use of non- renewable primary energy excluding non- renewable primary energy resources used as raw materials (PENRE) (net cal. value) [MJ]	2.95E+03
Use of non- renewable primary energy resources used as raw Materials (PENRM) (net cal. value) [MJ]	0.00E+00
Total use of non- renewable primary energy resources (PENRT) (net cal. value) [MJ]	2.95E+03
Use of secondary material [kg]	4.46E+02
Use of renewable secondary fuels (net cal. value) [MJ]	1.11E+01
Use of non- renewable secondary fuels (net cal. value) [MJ]	2.14E+01
Use of net fresh water [m ³]	3.60E-01
Hazardous waste disposed [kg]	5.94E-03
Non-hazardous waste disposed [kg]	1.20E-01
Radioactive waste disposed/stored [kg]	0.00E+00
Components for re-use [kg]	0.00E+00
Materials for recycling [kg]	0.00E+00
Materials for energy recovery [kg]	0.00E+00
Exported energy [MJ]	0.00E+00
Electricity use [kWh]	6.69E+01
Dust [kg]	2.00E-02

7.15 LCIA of cement products for Tikaria plant

7.15.1 Tikaria - ACC Concrete+ Xtra Strong Cement

LCIA	A1-A3
Global Warming Potential (GWP 100 years) [kg CO ₂ -Equiv.]	7.42E+02
Ozone Layer Depletion Potential (ODP, steady state) [kg CFC11-Equiv.]	1.09E-09
Acidification Potential (AP) [kg SO ₂ -Equiv.]	1.65E+00
Eutrophication Potential (EP) [kg Phosphate-Equiv.]	2.50E-01
Photochemical Ozone Creation Potential (POCP) [kg Ethene-Equiv.]	1.00E-01
Abiotic Depletion Potential (ADP elements) [kg Sb-Equiv.]	7.59E-04
Abiotic Depletion Potential (ADP-fossil fuels) (net cal. value) [MJ]	4.94E+03
Use of renewable primary energy excluding renewable primary energy resources used as raw materials (PERE) (net cal. value) [MJ]	3.33E+01
Use of renewable primary energy resources used as raw materials (PERM) (net cal. value) [MJ]	0.00E+00
Total use of renewable primary energy resources (PERT) (net cal. value) [MJ]	3.33E+01
Use of non- renewable primary energy excluding non- renewable primary energy resources used as raw materials (PENRE) (net cal. value) [MJ]	4.96E+03
Use of non- renewable primary energy resources used as raw Materials (PENRM) (net cal. value) [MJ]	0.00E+00
Total use of non- renewable primary energy resources (PENRT) (net cal. value) [MJ]	4.96E+03
Use of secondary material [kg]	3.30E+02
Use of renewable secondary fuels (net cal. value) [MJ]	4.65E+01
Use of non- renewable secondary fuels (net cal. value) [MJ]	8.66E+01
Use of net fresh water [m ³]	1.01E+00
Hazardous waste disposed [kg]	7.13E-03
Non-hazardous waste disposed [kg]	2.90E-01
Radioactive waste disposed/stored [kg]	0.00E+00
Components for re-use [kg]	0.00E+00
Materials for recycling [kg]	0.00E+00
Materials for energy recovery [kg]	0.00E+00
Exported energy [MJ]	0.00E+00
Electricity use [kWh]	6.53E+01
Dust [kg]	1.10E-01

7.15.2 Tikaria - ACC Gold Water Shield Cement

LCIA	A1-A3
Global Warming Potential (GWP 100 years) [kg CO ₂ -Equiv.]	7.09E+02
Ozone Layer Depletion Potential (ODP, steady state) [kg CFC11-Equiv.]	1.08E-09
Acidification Potential (AP) [kg SO ₂ -Equiv.]	1.59E+00
Eutrophication Potential (EP) [kg Phosphate-Equiv.]	2.40E-01
Photochemical Ozone Creation Potential (POCP) [kg Ethene-Equiv.]	1.00E-01
Abiotic Depletion Potential (ADP elements) [kg Sb-Equiv.]	7.59E-04
Abiotic Depletion Potential (ADP-fossil fuels) (net cal. value) [MJ]	4.77E+03
Use of renewable primary energy excluding renewable primary energy resources used as raw materials (PERE) (net cal. value) [MJ]	3.25E+01
Use of renewable primary energy resources used as raw materials (PERM) (net cal. value) [MJ]	0.00E+00
Total use of renewable primary energy resources (PERT) (net cal. value) [MJ]	3.25E+01
Use of non- renewable primary energy excluding non- renewable primary energy resources used as raw materials (PENRE) (net cal. value) [MJ]	4.78E+03
Use of non- renewable primary energy resources used as raw Materials (PENRM) (net cal. value) [MJ]	0.00E+00
Total use of non- renewable primary energy resources (PENRT) (net cal. value) [MJ]	4.78E+03
Use of secondary material [kg]	3.60E+02
Use of renewable secondary fuels (net cal. value) [MJ]	4.41E+01
Use of non- renewable secondary fuels (net cal. value) [MJ]	8.22E+01
Use of net fresh water [m ³]	1.01E+00
Hazardous waste disposed [kg]	7.13E-03
Non-hazardous waste disposed [kg]	2.80E-01
Radioactive waste disposed/stored [kg]	0.00E+00
Components for re-use [kg]	0.00E+00
Materials for recycling [kg]	0.00E+00
Materials for energy recovery [kg]	0.00E+00
Exported energy [MJ]	0.00E+00
Electricity use [kWh]	6.39E+01
Dust [kg]	8.00E-02

7.15.3 Tikaria - ACC Suraksha Power Cement

LCIA	A1-A3
Global Warming Potential (GWP 100 years) [kg CO ₂ -Equiv.]	7.10E+02
Ozone Layer Depletion Potential (ODP, steady state) [kg CFC11-Equiv.]	1.08E-09
Acidification Potential (AP) [kg SO ₂ -Equiv.]	1.59E+00
Eutrophication Potential (EP) [kg Phosphate-Equiv.]	2.40E-01
Photochemical Ozone Creation Potential (POCP) [kg Ethene-Equiv.]	1.00E-01
Abiotic Depletion Potential (ADP elements) [kg Sb-Equiv.]	7.59E-04
Abiotic Depletion Potential (ADP-fossil fuels) (net cal. value) [MJ]	4.78E+03
Use of renewable primary energy excluding renewable primary energy resources used as raw materials (PERE) (net cal. value) [MJ]	3.25E+01
Use of renewable primary energy resources used as raw materials (PERM) (net cal. value) [MJ]	0.00E+00
Total use of renewable primary energy resources (PERT) (net cal. value) [MJ]	3.25E+01
Use of non- renewable primary energy excluding non- renewable primary energy resources used as raw materials (PENRE) (net cal. value) [MJ]	4.79E+03
Use of non- renewable primary energy resources used as raw Materials (PENRM) (net cal. value) [MJ]	0.00E+00
Total use of non- renewable primary energy resources (PENRT) (net cal. value) [MJ]	4.79E+03
Use of secondary material [kg]	3.59E+02
Use of renewable secondary fuels (net cal. value) [MJ]	4.42E+01
Use of non- renewable secondary fuels (net cal. value) [MJ]	8.23E+01
Use of net fresh water [m ³]	1.01E+00
Hazardous waste disposed [kg]	7.13E-03
Non-hazardous waste disposed [kg]	2.80E-01
Radioactive waste disposed/stored [kg]	0.00E+00
Components for re-use [kg]	0.00E+00
Materials for recycling [kg]	0.00E+00
Materials for energy recovery [kg]	0.00E+00
Exported energy [MJ]	0.00E+00
Electricity use [kWh]	6.39E+01
Dust [kg]	8.00E-02

7.16 LCIA of cement products for Kolar plant

7.16.1 Kolar - ACC Concrete+ Xtra Strong Cement

LCIA	A1-A3
Global Warming Potential (GWP 100 years) [kg CO ₂ -Equiv.]	8.09E+02
Ozone Layer Depletion Potential (ODP, steady state) [kg CFC11-Equiv.]	4.63E-10
Acidification Potential (AP) [kg SO ₂ -Equiv.]	2.00E+00
Eutrophication Potential (EP) [kg Phosphate-Equiv.]	2.90E-01
Photochemical Ozone Creation Potential (POCP) [kg Ethene-Equiv.]	1.50E-01
Abiotic Depletion Potential (ADP elements) [kg Sb-Equiv.]	7.77E-04
Abiotic Depletion Potential (ADP-fossil fuels) (net cal. value) [MJ]	3.92E+03
Use of renewable primary energy excluding renewable primary energy resources used as raw materials (PERE) (net cal. value) [MJ]	6.89E+01
Use of renewable primary energy resources used as raw materials (PERM) (net cal. value) [MJ]	0.00E+00
Total use of renewable primary energy resources (PERT) (net cal. value) [MJ]	6.89E+01
Use of non- renewable primary energy excluding non- renewable primary energy resources used as raw materials (PENRE) (net cal. value) [MJ]	3.93E+03
Use of non- renewable primary energy resources used as raw Materials (PENRM) (net cal. value) [MJ]	0.00E+00
Total use of non- renewable primary energy resources (PENRT) (net cal. value) [MJ]	3.93E+03
Use of secondary material [kg]	2.32E+02
Use of renewable secondary fuels (net cal. value) [MJ]	1.67E+00
Use of non- renewable secondary fuels (net cal. value) [MJ]	1.44E+02
Use of net fresh water [m ³]	5.70E-01
Hazardous waste disposed [kg]	3.90E-04
Non-hazardous waste disposed [kg]	1.00E-01
Radioactive waste disposed/stored [kg]	0.00E+00
Components for re-use [kg]	0.00E+00
Materials for recycling [kg]	0.00E+00
Materials for energy recovery [kg]	0.00E+00
Exported energy [MJ]	0.00E+00
Electricity use [kWh]	9.04E+01
Dust [kg]	2.00E-02

7.16.2 Kolar- ACC Suraksha Power Cement

LCIA	A1-A3
Global Warming Potential (GWP 100 years) [kg CO ₂ -Equiv.]	6.92E+02
Ozone Layer Depletion Potential (ODP, steady state) [kg CFC11-Equiv.]	4.07E-10
Acidification Potential (AP) [kg SO ₂ -Equiv.]	1.78E+00
Eutrophication Potential (EP) [kg Phosphate-Equiv.]	2.60E-01
Photochemical Ozone Creation Potential (POCP) [kg Ethene-Equiv.]	1.20E-01
Abiotic Depletion Potential (ADP elements) [kg Sb-Equiv.]	7.54E-04
Abiotic Depletion Potential (ADP-fossil fuels) (net cal. value) [MJ]	3.37E+03
Use of renewable primary energy excluding renewable primary energy resources used as raw materials (PERE) (net cal. value) [MJ]	6.51E+01
Use of renewable primary energy resources used as raw materials (PERM) (net cal. value) [MJ]	0.00E+00
Total use of renewable primary energy resources (PERT) (net cal. value) [MJ]	6.51E+01
Use of non- renewable primary energy excluding non- renewable primary energy resources used as raw materials (PENRE) (net cal. value) [MJ]	3.38E+03
Use of non- renewable primary energy resources used as raw Materials (PENRM) (net cal. value) [MJ]	0.00E+00
Total use of non- renewable primary energy resources (PENRT) (net cal. value) [MJ]	3.38E+03
Use of secondary material [kg]	3.50E+02
Use of renewable secondary fuels (net cal. value) [MJ]	1.40E+00
Use of non- renewable secondary fuels (net cal. value) [MJ]	1.21E+02
Use of net fresh water [m ³]	5.30E-01
Hazardous waste disposed [kg]	3.69E-04
Non-hazardous waste disposed [kg]	9.00E-02
Radioactive waste disposed/stored [kg]	0.00E+00
Components for re-use [kg]	0.00E+00
Materials for recycling [kg]	0.00E+00
Materials for energy recovery [kg]	0.00E+00
Exported energy [MJ]	0.00E+00
Electricity use [kWh]	8.38E+01
Dust [kg]	1.00E-02

7.17 LCIA of cement products for Bellary plant

7.17.1 Bellary - ACC HPC Long Life Cement

LCIA	A1-A3
Global Warming Potential (GWP 100 years) [kg CO ₂ -Equiv.]	4.33E+02
Ozone Layer Depletion Potential (ODP, steady state) [kg CFC11-Equiv.]	2.44E-10
Acidification Potential (AP) [kg SO ₂ -Equiv.]	1.15E+00
Eutrophication Potential (EP) [kg Phosphate-Equiv.]	1.50E-01
Photochemical Ozone Creation Potential (POCP) [kg Ethene-Equiv.]	8.00E-02
Abiotic Depletion Potential (ADP elements) [kg Sb-Equiv.]	7.55E-04
Abiotic Depletion Potential (ADP-fossil fuels) (net cal. value) [MJ]	2.07E+03
Use of renewable primary energy excluding renewable primary energy resources used as raw materials (PERE) (net cal. value) [MJ]	4.16E+01
Use of renewable primary energy resources used as raw materials (PERM) (net cal. value) [MJ]	0.00E+00
Total use of renewable primary energy resources (PERT) (net cal. value) [MJ]	4.16E+01
Use of non- renewable primary energy excluding non- renewable primary energy resources used as raw materials (PENRE) (net cal. value) [MJ]	2.08E+03
Use of non- renewable primary energy resources used as raw Materials (PENRM) (net cal. value) [MJ]	0.00E+00
Total use of non- renewable primary energy resources (PENRT) (net cal. value) [MJ]	2.08E+03
Use of secondary material [kg]	5.76E+02
Use of renewable secondary fuels (net cal. value) [MJ]	7.60E-01
Use of non- renewable secondary fuels (net cal. value) [MJ]	6.54E+01
Use of net fresh water [m ³]	4.20E-01
Hazardous waste disposed [kg]	5.50E-05
Non-hazardous waste disposed [kg]	6.00E-02
Radioactive waste disposed/stored [kg]	0.00E+00
Components for re-use [kg]	0.00E+00
Materials for recycling [kg]	0.00E+00
Materials for energy recovery [kg]	0.00E+00
Exported energy [MJ]	0.00E+00
Electricity use [kWh]	5.06E+01
Dust [kg]	1.00E-02

7.17.2 Bellary - ACC F2R Superfast Cement

LCIA	A1-A3
Global Warming Potential (GWP 100 years) [kg CO ₂ -Equiv.]	5.31E+02
Ozone Layer Depletion Potential (ODP, steady state) [kg CFC11-Equiv.]	2.87E-10
Acidification Potential (AP) [kg SO ₂ -Equiv.]	1.35E+00
Eutrophication Potential (EP) [kg Phosphate-Equiv.]	1.80E-01
Photochemical Ozone Creation Potential (POCP) [kg Ethene-Equiv.]	1.00E-01
Abiotic Depletion Potential (ADP elements) [kg Sb-Equiv.]	7.56E-04
Abiotic Depletion Potential (ADP-fossil fuels) (net cal. value) [MJ]	2.55E+03
Use of renewable primary energy excluding renewable primary energy resources used as raw materials (PERE) (net cal. value) [MJ]	4.40E+01
Use of renewable primary energy resources used as raw materials (PERM) (net cal. value) [MJ]	0.00E+00
Total use of renewable primary energy resources (PERT) (net cal. value) [MJ]	4.40E+01
Use of non- renewable primary energy excluding non- renewable primary energy resources used as raw materials (PENRE) (net cal. value) [MJ]	2.56E+03
Use of non- renewable primary energy resources used as raw Materials (PENRM) (net cal. value) [MJ]	0.00E+00
Total use of non- renewable primary energy resources (PENRT) (net cal. value) [MJ]	2.56E+03
Use of secondary material [kg]	4.78E+02
Use of renewable secondary fuels (net cal. value) [MJ]	9.40E-01
Use of non- renewable secondary fuels (net cal. value) [MJ]	8.17E+01
Use of net fresh water [m ³]	4.50E-01
Hazardous waste disposed [kg]	6.51E-05
Non-hazardous waste disposed [kg]	7.00E-02
Radioactive waste disposed/stored [kg]	0.00E+00
Components for re-use [kg]	0.00E+00
Materials for recycling [kg]	0.00E+00
Materials for energy recovery [kg]	0.00E+00
Exported energy [MJ]	0.00E+00
Electricity use [kWh]	5.48E+01
Dust [kg]	1.00E-02

7.18 LCIA of cement products for Vizag plant

7.18.1 Vizag - ACC HPC Long Life Cement

LCIA	A1-A3
Global Warming Potential (GWP 100 years) [kg CO ₂ -Equiv.]	4.39E+02
Ozone Layer Depletion Potential (ODP, steady state) [kg CFC11-Equiv.]	2.04E-10
Acidification Potential (AP) [kg SO ₂ -Equiv.]	8.60E-01
Eutrophication Potential (EP) [kg Phosphate-Equiv.]	9.00E-02
Photochemical Ozone Creation Potential (POCP) [kg Ethene-Equiv.]	6.00E-02
Abiotic Depletion Potential (ADP elements) [kg Sb-Equiv.]	7.55E-04
Abiotic Depletion Potential (ADP-fossil fuels) (net cal. value) [MJ]	2.15E+03
Use of renewable primary energy excluding renewable primary energy resources used as raw materials (PERE) (net cal. value) [MJ]	4.40E+01
Use of renewable primary energy resources used as raw materials (PERM) (net cal. value) [MJ]	0.00E+00
Total use of renewable primary energy resources (PERT) (net cal. value) [MJ]	4.40E+01
Use of non- renewable primary energy excluding non- renewable primary energy resources used as raw materials (PENRE) (net cal. value) [MJ]	2.15E+03
Use of non- renewable primary energy resources used as raw Materials (PENRM) (net cal. value) [MJ]	0.00E+00
Total use of non- renewable primary energy resources (PENRT) (net cal. value) [MJ]	2.15E+03
Use of secondary material [kg]	6.22E+02
Use of renewable secondary fuels (net cal. value) [MJ]	0.00E+00
Use of non- renewable secondary fuels (net cal. value) [MJ]	1.79E+01
Use of net fresh water [m ³]	3.60E-01
Hazardous waste disposed [kg]	4.63E-05
Non-hazardous waste disposed [kg]	6.00E-02
Radioactive waste disposed/stored [kg]	0.00E+00
Components for re-use [kg]	0.00E+00
Materials for recycling [kg]	0.00E+00
Materials for energy recovery [kg]	0.00E+00
Exported energy [MJ]	0.00E+00
Electricity use [kWh]	5.97E+01
Dust [kg]	2.42E-03

7.18.2 Vizag - ACC F2R Superfast Cement

LCIA	A1-A3
Global Warming Potential (GWP 100 years) [kg CO ₂ -Equiv.]	5.46E+02
Ozone Layer Depletion Potential (ODP, steady state) [kg CFC11-Equiv.]	2.38E-10
Acidification Potential (AP) [kg SO ₂ -Equiv.]	9.70E-01
Eutrophication Potential (EP) [kg Phosphate-Equiv.]	1.10E-01
Photochemical Ozone Creation Potential (POCP) [kg Ethene-Equiv.]	7.00E-02
Abiotic Depletion Potential (ADP elements) [kg Sb-Equiv.]	7.55E-04
Abiotic Depletion Potential (ADP-fossil fuels) (net cal. value) [MJ]	2.69E+03
Use of renewable primary energy excluding renewable primary energy resources used as raw materials (PERE) (net cal. value) [MJ]	4.58E+01
Use of renewable primary energy resources used as raw materials (PERM) (net cal. value) [MJ]	0.00E+00
Total use of renewable primary energy resources (PERT) (net cal. value) [MJ]	4.58E+01
Use of non- renewable primary energy excluding non- renewable primary energy resources used as raw materials (PENRE) (net cal. value) [MJ]	2.70E+03
Use of non- renewable primary energy resources used as raw Materials (PENRM) (net cal. value) [MJ]	0.00E+00
Total use of non- renewable primary energy resources (PENRT) (net cal. value) [MJ]	2.70E+03
Use of secondary material [kg]	5.30E+02
Use of renewable secondary fuels (net cal. value) [MJ]	0.00E+00
Use of non- renewable secondary fuels (net cal. value) [MJ]	2.28E+01
Use of net fresh water [m ³]	3.90E-01
Hazardous waste disposed [kg]	5.45E-05
Non-hazardous waste disposed [kg]	6.00E-02
Radioactive waste disposed/stored [kg]	0.00E+00
Components for re-use [kg]	0.00E+00
Materials for recycling [kg]	0.00E+00
Materials for energy recovery [kg]	0.00E+00
Exported energy [MJ]	0.00E+00
Electricity use [kWh]	6.47E+01
Dust [kg]	3.09E-03