Environmental Product Declaration

In accordance with ISO 14025 and EN 15804:2012+A2:2019 for :

Clinker & Cement INSEE Vietnam

SIAM CITY CEMENT (VIET NAM) Ltd

Programme operator:	EPD International AB - Stockholm, Sweden
Registration number of EPD(s):	**S-P-03647**
Publication date:	2021-07-19
Valid until:	2026-07-18
Geographical scope:	**Vietnam**

GENERAL INFORMATION

Programme:	The International EPD® System, www.environdec.com	
EPD owner	**SiamCityCement (Vietnam) Ltd**	Address: 12th Floor, E-town Central, 11 Doan Van Bo Street, Ward 13, District 4, HCMC, Vietnam ○ *Phone: +84 28 73 017 018* ○ *Hotline: 1800 1718* ○ *Fax: +84 28 73 036 038* Website: www.insee.com.vn
Products	Clinker & Cement products portfolio	
Verification		
Name and organization of verifier	**Hudai Kara, PhD** - Managing Director **Metsims Sustainability Consulting** UK Head Office: 4 Clear Water Place, Oxford OX2 7NL, U.K. T : 0800 772 0185 - M :07557 351 476 **www.metsims.com**	
Data and location	**Oxford, United Kingdom, 2021.07.19**	
Signature		
This declaration is based on the European standard - EN 15804:2012+A2:2019 Independent verification of the declaration and data, according to EN ISO 14025 ☐ Internal ☑ External		
Reference standards:	*ISO 14025:2006, ISO 14020:2000,* EN 15804:2012+A2:2019*, PCR 2019:14 Construction-products and services, GCCA_Protokol V3_1_final_1103,*	
LCA Information		
Title	Life Cycle Assessment of Clinker & Cement production of INSEE Vietnam: 1000 kg average Clinker & Cement	
Date of Issue:	May 2021	
Preparer:	**Dung Thanh *Nguyen*** - *Sustainable Construction Manager* *Ecocycle and Sustainable Development Department* *Mobile: +84 90 8 674 558, Email: dungb.nguyen@siamcitycement.com* **Siam City Cement (Vietnam) Ltd** 12th Floor, E-town Central, 11 Doan Van Bo Street, Ward 13, District 4, HCMC, Vietnam	

This document serves as the report of Environmental Product Declarations (EPD) of construction products and intended to be used by consultants, architects, engineers, designers and procurers and for B2B, B2C. INSEE VN provides full information for customers to apply green building standards.

I. Product related information:

1. About the Company:

Being established in 1994, INSEE in Vietnam - earlier known as Holcim (Vietnam), has become over the years the leading cement producer and waste management solution provider in the South of Vietnam. We are proud that our products have been used in so many of the iconic buildings and infrastructure as well as housing and commercial developments in the South of Vietnam and how we have contributed to the economy, environment and society.

INSEE looks forward to contributing to Vietnam's national growth with the ambition to continuously provide innovative solutions to our customers while improving living condition for the community, protecting the environment, investments in people and enhancing sustainable construction. INSEE is committed to sustainability across our value chain that will pave the way to brighter futures.

"Build for Life", INSEE Vietnam believes that the world would be a better place if everything we build together can improve quality of life.

Manufacturing process

The most important component of cement according to TCVN 6260:2009 type PCB40, ASTM 1157 & EN 197-1. Is clinker produced from raw materials such as limestone and clay which are crushed, homogenized and fed into a rotary kiln. The raw materials are sintered at a temperature of 1450°C to form new compounds.

Clinker consists mainly of oxides of calcium, silicon, aluminums and iron. In a second phase calcium sulfates and possibly additional cementitious or inert materials are added to the clinker. All constituents are ground leading to a fine and homogenous powder with a daily production capacity of 5,000 tons of clinker.

The production of cement is subject to INSEE VN and Vietnam legislation, which address all relevant environmental effects like the excavation of natural raw materials, the rehabilitation of quarries, the recovery of energy and material from wastes and the emission of noise, dust and hazardous substances (NOx, SO2, heavy metals, etc.).

The Clinker & Cement is currently manufactured in the plants listed here below

	Plant	Address
1.	Hon Chong Cement plant	Binh An commune, Kien Luong District, Kien Giang Province
2.	Cat Lai Cement Terminal	Km 7, Nguyen Thi Dinh Street, Thanh My Loi Ward, Dist. 2, Ho Chi Minh City
3.	Thi Vai Cement Terminal	Phu My 1 Industrial Zone, Tan Thanh District, Ba Ria – Vung Tau Province
4.	Hiep Phuoc Cement Terminal	Hiep Phuoc Industrial Park, Nha Be District, Ho Chi Minh City

5.	Nhon Trach Terminal	Ong Keo Industrial Park, Phuoc Khanh commune, Nhon Trach District, Dong Nai Province

2. The company's progress:

INSEE VN has been successfully certified with scope applied to Development, Manufacturing and Distribution of Cement, Clinker; and Providing waste management services.

In order to respect the principles of sustainable development, INSEE Vietnam implements, maintains and continuously improves the integrated management system, in accordance with the applicable documentation:

* Quality Management System (QMS) since February 2003 according to ISO 9001:2018.
* Environmental Management System (EMS) since June 2006 according to ISO 14001:2018.
* Energy Management System (EnMS) since December 2018 according to ISO 50001:2018.
* Health and Safety Management System (SMS) ISO 45001:2018 certified in September 2019.
* Follow methodology - Cement CO2 and Energy Protocol, Version 3.1-Cement Sustainability Initiative (CSI) and European Cement Research Academy (ECRA).
* Products on Green Database of Vietnam Green Building Council since March 2014 up to this day. (http://greendatabase.vgbc.vn/en/structure)
* Certificated Green Label of Singapore Green Building Council since Aug 2017 up to this day. (https://web.sgbc.online/public/product/2/23/products)

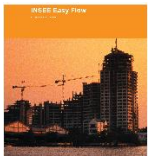
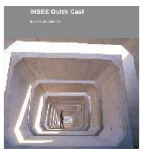
Organization Team:

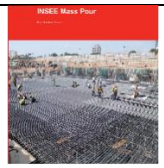
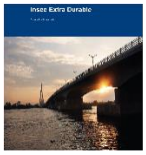
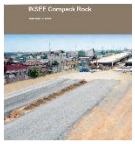
- Representative expert for Sustainable Construction
- Representative expert for Environment
- Quality Assurance and Testing Center 3 (Quatest 3) Vietnam

3. Technical description of the products:

No	Trade name	Significant characteristic & Recommended use	Product Standard
Cement Bag Segment			
01	INSEE Power-S (IPSC) 	INSEE Power-S Multi-purpose Cement for long-lasting concrete foundation. Conventional concrete often has visible holes, factors such as water (groundwater, alum water, high chlorine) and air will gradually core into the structure, affect to the steel, which causes rust and reduces life expectancy.	TCVN 6260:2009 type PCB40, CEM V/A (SR EN 197-1:2011)

	ECO Da Dung (EDDC) 	The new Eco Đa Dụng makes mortar construction faster, concrete pumping easier and increases labor productivity. As a result, the motar is smooth, adhesive and easy for plastering, bringing great benefits to the masonry works. High early strength of concrete from Eco Đa Dụng allows to remove the formwork early as well as reuse the formwork quickly, reducing labor costs, thus saving time of operation and cost incurred. Concrete usually has air holes which are latent detects. Eco Đa Dụng would fill the voids, limiting the penetration of these elements such as air, groundwater, alum-infected water, thus enhancing the durablitity of concrete.	TCVN 6260: 2009 type PCB 40. CEM V/A
	INSEE Power Fast (IPFC) 	High early strength of concrete from INSEE Power Fast allows to remove the formwork early as well as reuse the formwork quickly, reducing labor costs, thus saving time of operation and cost incurred. Concrete usually has air holes which are latent detects. INSEE Power Fast would fill the voids, limiting the penetration of these elements such as air, groundwater, alum-infected water, thus enhancing the durablitity of concrete.	TCVN 6260: 2009 type PCB 40 CEM V/A
02	INSEE Wall Pro (IWPC) 	INSEE Wall Pro is developed to be specialized for the tropical weather, offering top three value propositions: - Anti shrinkage cracks - Smoothness, high workability - Same ratio, same mortar volume Contains Super Flex active ingredients that are hydrated, strengthen moisture retention and slow down surface evaporation, so improve maximum of the phenomenon of shrinkage cracks.	TCVN 9202: 2012 MC 25 CEM II/B-M
03	Lavilla Extra CC40	Lavilla XTra Cement which is suitable for both all civil works and large projects.	TCVN 9501: 2013 type CC40, CEM V/A

	(LEC) 	Lavilla Xtra Cement produces high strength concrete to ensure the main quality of the work such as foundation, beam and floor beams, pillars, thus enhancing the prestige and quality of construction works.	(SR EN 197-1:2011)
04	INSEE Power Cast 	INSEE Power Cast is an super high early strength cement specifically designed for precast concrete, especially for spun pile, the formwork can be removed early and the concrete precast elements can be manipulated sooner : this speeds up the production cycle & saves investment cost Total of equivalent alkali content (Na_2O+0.658 K_2O) < 0.6% to avoid alkali aggregate reaction	TCVN 6260:2009 type PCB40, ASTM 1157 type HE
Bulk Cement Segment			
06	INSEE Easy Flow (IEFC) 	INSEE Easy Flow is an optimized cement specifically designed for Ready Mixed concrete customers who require long workability and stable strength for infrastructure and other construction projects. It also meets the needs of ready-mix companies looking to make concrete mixes with stable strength and flowability for use in curves, arches and other architectural effects.	TCVN 6260:2009 type PCB40, ASTM 1157 type GU, CEM II/A-S (SR EN 197-1:2011)
07	INSEE Quick Cast (IQCC) 	As INSEE Quick Cast offers a high early strength in concrete, the formwork can be removed early and the concrete precast elements can be manipulated sooner: this speeds up the production cycle and saves investment costs.	TCVN 6260:2009, ASTM C1157/C1157M-17 type HE, CEM II/A-S (SR EN 197-1:2011)
INSEE Slag Cement			
08	INSEE Mass Pour (IMPC)	The low heat of hydration of INSEE Mass Pour significantly reduces the risk of thermal cracking in massive concrete elements. This is especially important in structures such as large foundations for	TCVN 7712:2013 type PCB_{BFS}40-LH,

		high-rise buildings, tower pile caps for bridges, tunnels, dams and large quays.	ASTM C1157/C1157M-17 type LH, CEM III/B (SR EN 197-1:2011)
09	INSEE Extra Durable (IEDC) 	INSEE Extra Durable is a special cement designed for concrete with high durability requirements and for chemically aggressive environments (seawater, sulphates, acids, chlorides,). Infrastructure package project to prevent fast degradation of concrete structure linked to chloride corrosion of steel reinforcement and sulphate attack of concrete.	TCVN 7711: 2013 type PCB_{HSR}4HS, ASTM C1157/C1157M-17 type HS, CEM III/B (SR EN 197-1:2011)
10	INSEE Stable Soil (ISSC) 	It is well suited for Cement Deep Mixing applications as well as ***Jet-grouting*** and any other type of soil mixing, which are used for the construction of ports and container quays, infrastructure like tunnels and bridges, or airports and Highrise buildings in phase of ground improvement. This high-quality stabilization increases the admissible load on the treated layer, can reduce the number or size of the required columns which reduces the costs of the total jobsite.	TCVN 4316:2007 PCB_{BFS}40-Type II , CEM III/ B (SR EN 197-1:2011)
11	INSEE Compact Rock (ICRC) 	It is well suited for and/cement mat and cement treated base layer for roads, industrial platforms, ports, etc.. The aggregate/cement mix, using INSEE Compact Rock, has a longer initial setting time, which allows more time for transport, leveling and compaction and assures a better quality of the compacted layer.	TCVN 4316:2007 PCB_{BFS}40-Type II, CEM III/B (SR EN 197-1:2011)

4. Declared unit:

The declaration is established for the average product of these manufacturing plants. The average is based on the accounted production volume of each plant. As the applications of Clinker or Cement as an intermediate material are numerous, a unique functional unit cannot be defined and therefore this EPD is based on a declared unit = 1000kg of Clinker or Cement. SI units shall be used.

Preferred power and energy units are: kW (MW) for power, kWh (MWh) for electric energy, MJ for fuels

5. Description of underlying LCA – Based Information

System boundaries for Clinker & Cement - *Fig. 1.1*

The main process for Clinker & Cement production of INSEE VN are highlighted as follows:

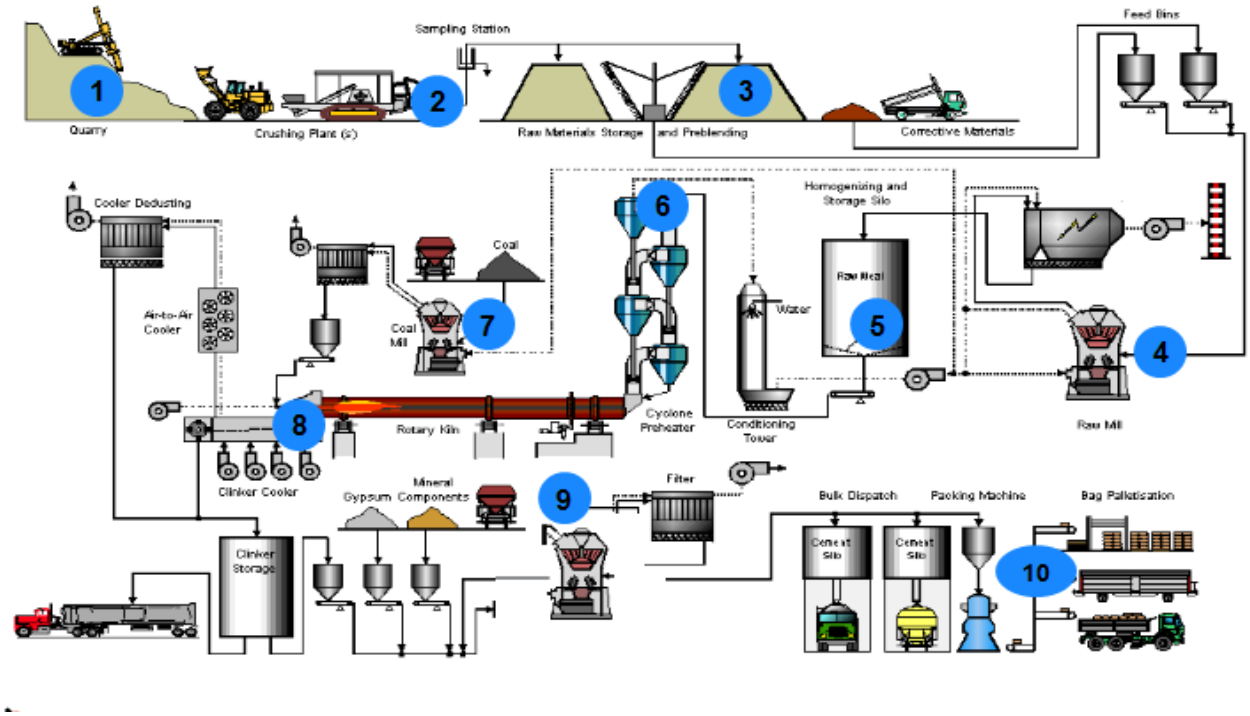


Fig. 1.1 – Boundary of the industry-average cement production processes at INSEE VietNam.

Using terminology from EN 15804, the Gradle to Gate life cycle is broken down into three life cycle stages:

- A1 - Raw material excavation & preparation - Stage 1, 2,3
  - Production of raw mix – Stage 4,5
- A2 - Burning of clinker & clinker production - Stage 6,7,8
- A3 - Cement production & storage of cement for dispatch - Stage 9,10

The Upstream Processes (A1) include:

- Exploiting raw materials: Limestone is exploited from three mines of Cay Xoai, Bai Voi and Khoe La; The clay is mined from the Binh Tri clay mine
- The stage of crushing limestone from size <1000mm down to size <100mm
- Preliminary mixing stage: limestone after crushing and clay is mixed in certain proportions and controlled by PGNAA analyzer.
- Raw material grinding stage: the homogeneous mixture of limestone and clay combined with corrected materials such as red stone and sand is quantified and put into the raw material mill.
- Raw material coming out of the mill is put into storage silo and homogenized before being put into the clinker kiln

The Core Processes (A2) include:

- Clinker heating stage: Raw material is fed into the pre-heating tower to heat and decompose CaCO3 before going into the clinker kiln, the material is further heated in the rotary kiln until 1450^{o}C to form clinker
- Coal crushing stage: Coal is stored in the warehouse and transported by conveyor to the mill. After grinding, the fine coal is stored in the intermediate bin to feed into the clinker kiln. In addition, INSEE Cement Plant Viet Nam also uses a part of alternative fuel from the co-processing of waste. Co-processing technology (replacing coal with alternative waste fuel) is a sustainable waste treatment solution: over 1.2 million tonnes of waste have been safely co-processed so far by INSEE and zero ashes were sent to landfill.
- Clinker cooling stage: Clinker is cooled down from 1450^{o}C to <150^{o}C, then put into the silo. In addition, INSEE VN uses waste heat to operate the Waste Heat Recovery Power Plant allows reduction of electricity consumption by 25 per cent, generating 6.3 megawatt.

The Core Processes (A3) include:

- Cement grinding stage: clinker, gypsum and active mineral additives are quantified and put into two roller mills (vertical mill) to grind into cement. (Mineral additives: Slag (Blast furnace), Fly-ash (Thermal power plant) accounts for a high proportion in the cement production process)
- Cement after grinding is stored in silos, part of the cement is transferred to Hiep Phuoc, Thi Vai, Nhon Trạch terminal, a part is delivered to customers at the Hon Chong plant bagging plant in the form of 50kg bags or bulk cement.

The distribution processes (A4) include:

- Bag cement (with a maximum range of 200 square kilometers): Distributed over 90% to official distributors and retailer shops by vehicles: barge, inland waterway ship, truck, bleck truck & workers. The rest 10% is delivered directly to the project customer by truck.
- Bulk cement (with a maximum range of 400 square kilometers) : Delivered by cement tank truck to batching plants and precast concrete plant

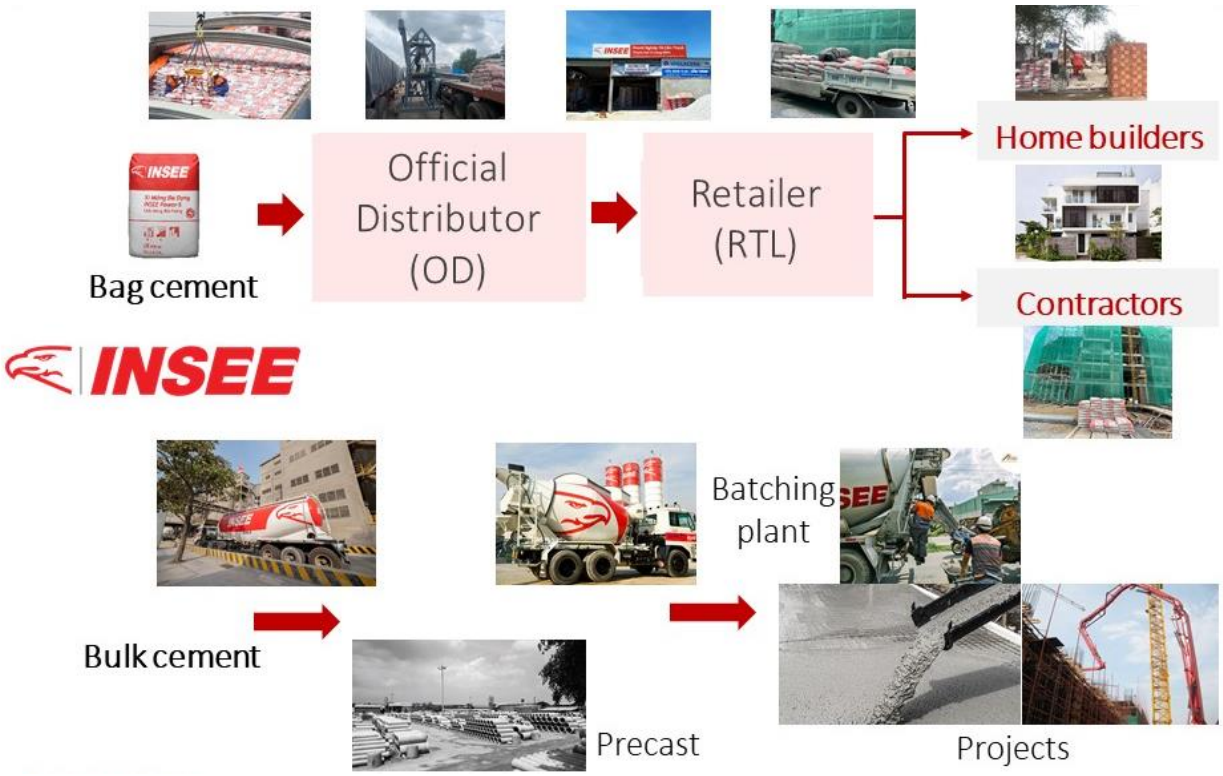


Fig. 1.2 – The distribution cement processes of INSEE Vietnam

II. Environmental performance-related information & estimations and methodology

2.1 Main product components

Clinker INSEE VN is ground to a fine powder and used as the binder in many cement products. A little gypsum is sometimes added. Clinker, if stored in dry conditions, can be kept for several months without appreciable loss of quality.

TABLE 1.1 : Composition and Technical Specification of Clinker INSEE VN

	Unit	Clinker 2020	Remark
SiO_2	%	21.79	
Al_2O_3	%	5.19	
Fe_2O_3	%	3.44	
CaO	%	66.43	
MgO	%	1.68	
SO_3	%	0.33	
Cl	%	0.02	
LOI		0.48	
IR	%	n/a	
Free CaO	%	1.19	
Cr (IV)	ppm	n/a	

K_2O	%	0.56	
Na_2O	%	0.18	
Na_2O eq	%	0.55	
LSF		95.8	
SM		2.53	
AM		1.51	
C_3S_Bogue	%	60.3	
C_2S_Bogue	%	17.0	
C_3A_Bogue	%	7.9	
C_4AF_Bogue	%	10.5	
C_3S+C_2S	%	77.3	
CaO/SiO_2		3.05	
Specific gravity	g/cm^3	3.14	
Specific Surface	cm^2/g	2960	

Residue on 0.045 mm	%	17.1	
Soundness	mm	n/a	
Normal consistency	%	25.3	
Initial setting time	min	115	
Residue on seive 40 mm	%	n/a	
Residue on seive 25 mm	%	13.9	
Residue on seive 10 mm	%	n/a	R8mm = 55.9
3D Strength	Mpa	34.5	2D not available
7D Strength	Mpa	41.9	
28D Strength	Mpa	50.7	

INSEE VN Cement according to EN 197-1 (TCVN 6260:2009, ASTM C1157) is produced by grinding and mixing the constituents defined in the standard.

Reduce the clinker factor by using different materials such as Pozzolana, Limestone, Flyash (coal thermal power plant) and steel Slag, Alternative fuels such are part of the energy mix. Proper adjustment and maintenance of the system is also considered to be the best way of increasing energy efficiency.

TABLE 1.2 : Composition and Technical Specification of Cement INSEE VN

No	Name	Standards (EN 197-1)	% Recycled Content (Slag , Flyash, Pozzolan, Limestone, Calcium sulfate usage at least)	% OPC
Bag Segment				
1	INSEE Da Dung Power-S INSEE Power Fast ECO Da Dung	CEM IV/B	44	56
2	INSEE Wall Pro	CEM II/B-M	60	40
3	Lavilla Extra CC40	CEM V/A	60	40
4	INSEE Power Cast	CEM II/A-S	13	87
Bulk Segment				
5	INSEE Easy Flow INSEE Quick Cast	CEM II/A-S	28	72
Slag Cement				
6	INSEE Mass Pour	CEM III/B	70	30
7	INSEE Extra Durable	CEM III/B	70	30
8	INSEE Stable Soil	CEM III/B	70	30
9	INSEE Compact Rock	CEM III/B	70	30

2.2 Estimations and methodology

Based on data 2020 from all INSEE Clinker & Cement plants in Vietnam follow methodology - Cement CO2 and Energy Protocol, Version 3.1, CO2 Emissions and Energy Inventory with was developed by the WBCSD Cement Sustainability Initiative (CSI) and European Cement Research Academy (ECRA).

This LCA was modelled with the program EPD Tool v3.0 / CML v4.7 from the Global Cement and Concrete Association (GCCA).

2.4 Result - Potential environmental impacts derived from LCA:

This EPD is established for the modules A1, A2 and A3 (X = included in LCA, MND = Module Not Declared).

Product Stage			Construction Stage		Use Stage							End of Life Stage				Benefits and loads beyond the system boundary
Raw material supply	Transport	Manufacturing	Transport	Construction-Installation process	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-recovery
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

TABLE 1.3 : Life-Cycle Stages and Modules

2.4.1 For Clinker product: *Impact categories considered, as per the PCR 1000 kg average* ***Clinker INSEE VN***

No	Core environmental impact indicators		
	Indicator	**A1-A3 (Total)**	**Unit**
1	Global Warming Potential total	909.6	kg CO_2 eq.
2	Global Warming Potential fossil fuels	909.5	kg CO_2 eq.
3	Global Warming Potential biogenic	4.09E-02	kg CO_2 eq.
4	Global Warming Potential land use and land use change	4.40E-02	kg CO_2 eq.
5	Depletion potential of the stratospheric ozone layer	4.73E-06	kg CFC 11 eq.
6	Acidification potential, Accumulated Exceedance	1.979	mol H+ eq.
7	Eutrophication potential, fraction of nutrients reaching freshwater end compartment	0.3396	kg PO_4 eq.
8	Eutrophication potential, fraction of nutrients reaching freshwater end compartment*	0.1108	kg P eq.

9	Eutrophication potential, fraction of nutrients reaching marine end compartment	7.05E-03	kg N eq.
10	Eutrophication potential, Accumulated Exceedance	8.215	mol N eq.
11	Formation potential of tropospheric ozone	2.008	kg NMVOC eq.
12	Abiotic depletion potential for non- fossil resources	1.05E-04	kg Sb eq.
13	Abiotic depletion for fossil resources potential	2882	MJ, net calorific value
14	Water (user) deprivation potential, deprivation-weighted water consumption	24.96	m^3 world eq. deprived
	Additional environmental impact indicators		
15	Potential incidence of disease due to PM emissions	1.38E-05	Disease incidence
16	Potential Human exposure efficiency relative to U235	3080	kBq U235 eq.
17	Potential Comparative Toxic Unit for ecosystems	29.59	CTUe
18	Potential Comparative Toxic Unit for humans - cancer	4.29E-04	CTUh
19	Potential Comparative Toxic Unit for humans - non-cancer	5.01E-06	CTUh
20	Potential soil quality index	984.5	dimensionless
	Parameters describing resource use		
21	Use of renewable primary energy excluding renewable primary energy resources used as raw materials	84.41	MJ, net calorific value
22	Use of renewable primary energy resources used as raw materials	0	MJ, net calorific value
23	Total use of renewable primary energy resources	84.41	MJ, net calorific value
24	Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	3076	MJ, net calorific value
25	Use of non-renewable primary energy resources used as raw materials	0	MJ, net calorific value
26	Total use of non-renewable primary energy resources	3076	MJ, net calorific value
27	Use of secondary materials	33.37	kg
28	Use of renewable secondary fuels	91.93	MJ, net calorific value
29	Use of non-renewable secondary fuels	89.77	MJ, net calorific value
30	Net use of fresh water	0.7257	m^3
	Other environmental information describing waste categories		
31	Hazardous waste disposed	7.79E-03	kg
32	Non-hazardous waste disposed	129.3	kg
33	Radioactive waste disposed	0	kg
	Extra indicators		
34	Emissions from calcination and removals from carbonation	525	kg CO_2 eq.

35	Emissions from combustion of waste from renewable sources used in production processes	0.3433	kg CO_2 eq.
36	Emissions from combustion of waste from non-renewable sources used in production processes	10.05	kg CO_2 eq.

2.4.2 For Cement product: *Impact categories considered, as per the PCR 1000 kg average* ***INSEE Power S, Eco Da Dung, Insee Power Fast***

a. Produced at Hon Chong Plant

No	Core environmental impact indicators		
	Indicator	**A1-A3 (Total)**	**Unit**
1	Global Warming Potential total	582	kg CO_2 eq.
2	Global Warming Potential fossil fuels	581.9	kg CO_2 eq.
3	Global Warming Potential biogenic	6.01E-02	kg CO_2 eq.
4	Global Warming Potential land use and land use change	5.95E-02	kg CO_2 eq.
5	Depletion potential of the stratospheric ozone layer	5.71E-06	kg CFC 11 eq.
6	Acidification potential, Accumulated Exceedance	1.698	mol H+ eq.
7	Eutrophication potential, fraction of nutrients reaching freshwater end compartment	0.3154	kg PO_4 eq.
8	Eutrophication potential, fraction of nutrients reaching freshwater end compartment*	0.1029	kg P eq.
9	Eutrophication potential, fraction of nutrients reaching marine end compartment	6.71E-03	kg N eq.
10	Eutrophication potential, Accumulated Exceedance	5.536	mol N eq.
11	Formation potential of tropospheric ozone	1.398	kg NMVOC eq.
12	Abiotic depletion potential for non- fossil resources	1.07E-04	kg Sb eq.
13	Abiotic depletion for fossil resources potential	2489	MJ, net calorific value
14	Water (user) deprivation potential, deprivation-weighted water consumption	23.5	m^3 world eq. deprived
	Additional environmental impact indicators		
15	Potential incidence of disease due to PM emissions	9.98E-06	Disease incidence
16	Potential Human exposure efficiency relative to U235	4187	kBq U235 eq.
17	Potential Comparative Toxic Unit for ecosystems	31.64	CTUe
18	Potential Comparative Toxic Unit for humans - cancer	2.41E-04	CTUh
19	Potential Comparative Toxic Unit for humans - non-cancer	6.29E-06	CTUh
20	Potential soil quality index	954.1	dimensionless
	Parameters describing resource use		

21	Use of renewable primary energy excluding renewable primary energy resources used as raw materials	132.5	MJ, net calorific value
22	Use of renewable primary energy resources used as raw materials	0	MJ, net calorific value
23	Total use of renewable primary energy resources	132.5	MJ, net calorific value
24	Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	2626	MJ, net calorific value
25	Use of non-renewable primary energy resources used as raw materials	75.52	MJ, net calorific value
26	Total use of non-renewable primary energy resources	2701	MJ, net calorific value
27	Use of secondary materials	143.2	kg
28	Use of renewable secondary fuels	51.74	MJ, net calorific value
29	Use of non-renewable secondary fuels	50.53	MJ, net calorific value
30	Net use of fresh water	0.6903	m^3
	Other environmental information describing waste categories		
31	Hazardous waste disposed	1.22E-02	kg
32	Non-hazardous waste disposed	202	kg
33	Radioactive waste disposed	0	kg
	Extra indicators		
34	Emissions from calcination and removals from carbonation	295.3	kg CO_2 eq.
35	Emissions from combustion of waste from renewable sources used in production processes	0.1932	kg CO_2 eq.
36	Emissions from combustion of waste from non-renewable sources used in production processes	5.655	kg CO_2 eq.

b. Produced at Thi Vai Terminal

No	Core environmental impact indicators		
	Indicator	**A1-A3 (Total)**	**Unit**
1	Global Warming Potential total	606	kg CO_2 eq.
2	Global Warming Potential fossil fuels	605.8	kg CO_2 eq.
3	Global Warming Potential biogenic	7.91E-02	kg CO_2 eq.
4	Global Warming Potential land use and land use change	7.04E-02	kg CO_2 eq.
5	Depletion potential of the stratospheric ozone layer	8.47E-06	kg CFC 11 eq.
6	Acidification potential, Accumulated Exceedance	2.123	mol H+ eq.
7	Eutrophication potential, fraction of nutrients reaching freshwater end compartment	0.3479	kg PO_4 eq.
8	Eutrophication potential, fraction of nutrients reaching freshwater end compartment*	0.1135	kg P eq.

9	Eutrophication potential, fraction of nutrients reaching marine end compartment	7.27E-03	kg N eq.
10	Eutrophication potential, Accumulated Exceedance	5.332	mol N eq.
11	Formation potential of tropospheric ozone	1.354	kg NMVOC eq.
12	Abiotic depletion potential for non- fossil resources	1.39E-04	kg Sb eq.
13	Abiotic depletion for fossil resources potential	3070	MJ, net calorific value
14	Water (user) deprivation potential, deprivation-weighted water consumption	50.19	m^3 world eq. deprived
	Additional environmental impact indicators		
15	Potential incidence of disease due to PM emissions	1.36E-05	Disease incidence
16	Potential Human exposure efficiency relative to U235	5466	kBq U235 eq.
17	Potential Comparative Toxic Unit for ecosystems	59.57	CTUe
18	Potential Comparative Toxic Unit for humans - cancer	1.13E-04	CTUh
19	Potential Comparative Toxic Unit for humans - non-cancer	2.23E-05	CTUh
20	Potential soil quality index	1165	dimensionless
	Parameters describing resource use		
21	Use of renewable primary energy excluding renewable primary energy resources used as raw materials	144.7	MJ, net calorific value
22	Use of renewable primary energy resources used as raw materials	0	MJ, net calorific value
23	Total use of renewable primary energy resources	144.7	MJ, net calorific value
24	Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	3248	MJ, net calorific value
25	Use of non-renewable primary energy resources used as raw materials	75.52	MJ, net calorific value
26	Total use of non-renewable primary energy resources	3324	MJ, net calorific value
27	Use of secondary materials	177.4	kg
28	Use of renewable secondary fuels	62.16	MJ, net calorific value
29	Use of non-renewable secondary fuels	64.41	MJ, net calorific value
30	Net use of fresh water	1.267	m^3
	Other environmental information describing waste categories		
31	Hazardous waste disposed	1.20E-02	kg
32	Non-hazardous waste disposed	35.89	kg
33	Radioactive waste disposed	0	kg
	Extra indicators		
34	Emissions from calcination and removals from carbonation	290.1	kg CO_2 eq.

35	Emissions from combustion of waste from renewable sources used in production processes	0.2321	kg CO_2 eq.
36	Emissions from combustion of waste from non-renewable sources used in production processes	6.169	kg CO_2 eq.

c. Produced at HIEP PHUOC Terminal

No	Core environmental impact indicators		
	Indicator	**A1-A3 (Total)**	**Unit**
1	Global Warming Potential total	587.9	kg CO_2 eq.
2	Global Warming Potential fossil fuels	587.8	kg CO_2 eq.
3	Global Warming Potential biogenic	6.30E-02	kg CO_2 eq.
4	Global Warming Potential land use and land use change	6.21E-02	kg CO_2 eq.
5	Depletion potential of the stratospheric ozone layer	6.69E-06	kg CFC 11 eq.
6	Acidification potential, Accumulated Exceedance	1.798	mol H+ eq.
7	Eutrophication potential, fraction of nutrients reaching freshwater end compartment	0.2978	kg PO_4 eq.
8	Eutrophication potential, fraction of nutrients reaching freshwater end compartment*	9.71E-02	kg P eq.
9	Eutrophication potential, fraction of nutrients reaching marine end compartment	6.27E-03	kg N eq.
10	Eutrophication potential, Accumulated Exceedance	5.498	mol N eq.
11	Formation potential of tropospheric ozone	1.398	kg NMVOC eq.
12	Abiotic depletion potential for non- fossil resources	1.18E-04	kg Sb eq.
13	Abiotic depletion for fossil resources potential	2629	MJ, net calorific value
14	Water (user) deprivation potential, deprivation-weighted water consumption	30.83	m^3 world eq. deprived
	Additional environmental impact indicators		
15	Potential incidence of disease due to PM emissions	1.07E-05	Disease incidence
16	Potential Human exposure efficiency relative to U235	4543	kBq U235 eq.
17	Potential Comparative Toxic Unit for ecosystems	38.91	CTUe
18	Potential Comparative Toxic Unit for humans - cancer	2.12E-04	CTUh
19	Potential Comparative Toxic Unit for humans - non-cancer	1.00E-05	CTUh
20	Potential soil quality index	1021	dimensionless
	Parameters describing resource use		
21	Use of renewable primary energy excluding renewable primary energy resources used as raw materials	140.6	MJ, net calorific value

22	Use of renewable primary energy resources used as raw materials	0	MJ, net calorific value
23	Total use of renewable primary energy resources	140.6	MJ, net calorific value
24	Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	2774	MJ, net calorific value
25	Use of non-renewable primary energy resources used as raw materials	75.52	MJ, net calorific value
26	Total use of non-renewable primary energy resources	2849	MJ, net calorific value
27	Use of secondary materials	153.7	kg
28	Use of renewable secondary fuels	54.22	MJ, net calorific value
29	Use of non-renewable secondary fuels	53.81	MJ, net calorific value
30	Net use of fresh water	0.8316	m^3
	Other environmental information describing waste categories		
31	Hazardous waste disposed	4.85E-03	kg
32	Non-hazardous waste disposed	64.8	kg
33	Radioactive waste disposed	0	kg
	Extra indicators		
34	Emissions from calcination and removals from carbonation	294.5	kg CO_2 eq.
35	Emissions from combustion of waste from renewable sources used in production processes	0.2025	kg CO_2 eq.
36	Emissions from combustion of waste from non-renewable sources used in production processes	5.782	kg CO_2 eq.

2.4.3 For Cement product: Impact categories considered, as per the PCR 1000 kg average INSEE Wall Pro produced at Hon Chong plant

No	Core environmental impact indicators		
	Indicator	**A1-A3 (Total)**	**Unit**
1	Global Warming Potential total	505.3	kg CO_2 eq.
2	Global Warming Potential fossil fuels	505.2	kg CO_2 eq.
3	Global Warming Potential biogenic	6.06E-02	kg CO_2 eq.
4	Global Warming Potential land use and land use change	5.83E-02	kg CO_2 eq.
5	Depletion potential of the stratospheric ozone layer	5.78E-06	kg CFC 11 eq.
6	Acidification potential, Accumulated Exceedance	1.522	mol H+ eq.
7	Eutrophication potential, fraction of nutrients reaching freshwater end compartment	0.2484	kg PO_4 eq.
8	Eutrophication potential, fraction of nutrients reaching freshwater end compartment*	8.10E-02	kg P eq.

9	Eutrophication potential, fraction of nutrients reaching marine end compartment	5.36E-03	kg N eq.
10	Eutrophication potential, Accumulated Exceedance	4.902	mol N eq.
11	Formation potential of tropospheric ozone	1.246	kg NMVOC eq.
12	Abiotic depletion potential for non- fossil resources	9.74E-05	kg Sb eq.
13	Abiotic depletion for fossil resources potential	2204	MJ, net calorific value
14	Water (user) deprivation potential, deprivation-weighted water consumption	40.56	m^3 world eq. deprived
	Additional environmental impact indicators		
15	Potential incidence of disease due to PM emissions	8.78E-06	Disease incidence
16	Potential Human exposure efficiency relative to U235	4088	kBq U235 eq.
17	Potential Comparative Toxic Unit for ecosystems	30.57	CTUe
18	Potential Comparative Toxic Unit for humans - cancer	2.08E-04	CTUh
19	Potential Comparative Toxic Unit for humans - non-cancer	6.69E-06	CTUh
20	Potential soil quality index	1382	dimensionless
	Parameters describing resource use		
21	Use of renewable primary energy excluding renewable primary energy resources used as raw materials	173	MJ, net calorific value
22	Use of renewable primary energy resources used as raw materials	0	MJ, net calorific value
23	Total use of renewable primary energy resources	173	MJ, net calorific value
24	Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	2319	MJ, net calorific value
25	Use of non-renewable primary energy resources used as raw materials	75.52	MJ, net calorific value
26	Total use of non-renewable primary energy resources	2394	MJ, net calorific value
27	Use of secondary materials	100.1	kg
28	Use of renewable secondary fuels	44.5	MJ, net calorific value
29	Use of non-renewable secondary fuels	43.45	MJ, net calorific value
30	Net use of fresh water	1.184	m^3
	Other environmental information describing waste categories		
31	Hazardous waste disposed	1.16E-02	kg
32	Non-hazardous waste disposed	191.9	kg
33	Radioactive waste disposed	0	kg
	Extra indicators		
34	Emissions from calcination and removals from carbonation	254.1	kg CO_2 eq.

35	Emissions from combustion of waste from renewable sources used in production processes	0.1662	kg CO_2 eq.
36	Emissions from combustion of waste from non-renewable sources used in production processes	4.865	kg CO_2 eq.

*2.4.4 **For Cement product:** Impact categories considered, as per the PCR 1000 kg average **Lavila Extra CC40 produced at Nhon Trach Terminal***

No	Core environmental impact indicators		
	Indicator	**A1-A3 (Total)**	**Unit**
1	Global Warming Potential total	507.9	kg CO_2 eq.
2	Global Warming Potential fossil fuels	507.8	kg CO_2 eq.
3	Global Warming Potential biogenic	6.78E-02	kg CO_2 eq.
4	Global Warming Potential land use and land use change	6.45E-02	kg CO_2 eq.
5	Depletion potential of the stratospheric ozone layer	7.11E-06	kg CFC 11 eq.
6	Acidification potential, Accumulated Exceedance	1.843	mol H+ eq.
7	Eutrophication potential, fraction of nutrients reaching freshwater end compartment	0.3151	kg PO_4 eq.
8	Eutrophication potential, fraction of nutrients reaching freshwater end compartment*	0.1028	kg P eq.
9	Eutrophication potential, fraction of nutrients reaching marine end compartment	6.62E-03	kg N eq.
10	Eutrophication potential, Accumulated Exceedance	4.477	mol N eq.
11	Formation potential of tropospheric ozone	1.168	kg NMVOC eq.
12	Abiotic depletion potential for non- fossil resources	1.20E-04	kg Sb eq.
13	Abiotic depletion for fossil resources potential	2705	MJ, net calorific value
14	Water (user) deprivation potential, deprivation-weighted water consumption	37.84	m^3 world eq. deprived
	Additional environmental impact indicators		
15	Potential incidence of disease due to PM emissions	1.11E-05	Disease incidence
16	Potential Human exposure efficiency relative to U235	4699	kBq U235 eq.
17	Potential Comparative Toxic Unit for ecosystems	44.05	CTUe
18	Potential Comparative Toxic Unit for humans - cancer	1.14E-06	CTUh
19	Potential Comparative Toxic Unit for humans - non-cancer	3.59E-05	CTUh
20	Potential soil quality index	1019	dimensionless
	Parameters describing resource use		
21	Use of renewable primary energy excluding renewable primary energy resources used as raw materials	142.9	MJ, net calorific value

22	Use of renewable primary energy resources used as raw materials	0	MJ, net calorific value
23	Total use of renewable primary energy resources	142.9	MJ, net calorific value
24	Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	2859	MJ, net calorific value
25	Use of non-renewable primary energy resources used as raw materials	75.52	MJ, net calorific value
26	Total use of non-renewable primary energy resources	2934	MJ, net calorific value
27	Use of secondary materials	381.3	kg
28	Use of renewable secondary fuels	141.3	MJ, net calorific value
29	Use of non-renewable secondary fuels	44.52	MJ, net calorific value
30	Net use of fresh water	0.974	m^3
	Other environmental information describing waste categories		
31	Hazardous waste disposed	1.76E-02	kg
32	Non-hazardous waste disposed	43.59	kg
33	Radioactive waste disposed	0	kg
	Extra indicators		
34	Emissions from calcination and removals from carbonation	225.2	kg CO_2 eq.
35	Emissions from combustion of waste from renewable sources used in production processes	0.5278	kg CO_2 eq.
36	Emissions from combustion of waste from non-renewable sources used in production processes	3.796	kg CO_2 eq.

2.4.5 ***For Cement product:*** *Impact categories considered, as per the PCR 1000 kg average* ***INSEE Power Cast produced***

a. ***Produced at Hon Chong Plant***

No	Core environmental impact indicators		
	Indicator	**A1-A3 (Total)**	**Unit**
1	Global Warming Potential total	870.3	kg CO_2 eq.
2	Global Warming Potential fossil fuels	870.1	kg CO_2 eq.
3	Global Warming Potential biogenic	6.01E-02	kg CO_2 eq.
4	Global Warming Potential land use and land use change	6.97E-02	kg CO_2 eq.
5	Depletion potential of the stratospheric ozone layer	6.79E-06	kg CFC 11 eq.
6	Acidification potential, Accumulated Exceedance	2.258	mol H+ eq.
7	Eutrophication potential, fraction of nutrients reaching freshwater end compartment	0.3901	kg PO_4 eq.
8	Eutrophication potential, fraction of nutrients reaching freshwater end compartment*	0.1272	kg P eq.

9	Eutrophication potential, fraction of nutrients reaching marine end compartment	8.28E-03	kg N eq.
10	Eutrophication potential, Accumulated Exceedance	8.084	mol N eq.
11	Formation potential of tropospheric ozone	1.997	kg NMVOC eq.
12	Abiotic depletion potential for non- fossil resources	1.38E-04	kg Sb eq.
13	Abiotic depletion for fossil resources potential	3225	MJ, net calorific value
14	Water (user) deprivation potential, deprivation-weighted water consumption	48.88	m^3 world eq. deprived
	Additional environmental impact indicators		
15	Potential incidence of disease due to PM emissions	1.34E-05	Disease incidence
16	Potential Human exposure efficiency relative to U235	4879	kBq U235 eq.
17	Potential Comparative Toxic Unit for ecosystems	37.07	CTUe
18	Potential Comparative Toxic Unit for humans - cancer	3.84E-04	CTUh
19	Potential Comparative Toxic Unit for humans - non-cancer	7.56E-06	CTUh
20	Potential soil quality index	1309	dimensionless
	Parameters describing resource use		
21	Use of renewable primary energy excluding renewable primary energy resources used as raw materials	169.9	MJ, net calorific value
22	Use of renewable primary energy resources used as raw materials	0	MJ, net calorific value
23	Total use of renewable primary energy resources	169.9	MJ, net calorific value
24	Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	3472	MJ, net calorific value
25	Use of non-renewable primary energy resources used as raw materials	0	MJ, net calorific value
26	Total use of non-renewable primary energy resources	3472	MJ, net calorific value
27	Use of secondary materials	29.85	kg
28	Use of renewable secondary fuels	82.26	MJ, net calorific value
29	Use of non-renewable secondary fuels	80.32	MJ, net calorific value
30	Net use of fresh water	1.435	m^3
	Other environmental information describing waste categories		
31	Hazardous waste disposed	1.48E-02	kg
32	Non-hazardous waste disposed	245	kg
33	Radioactive waste disposed	0	kg
	Extra indicators		
34	Emissions from calcination and removals from carbonation	469.7	kg CO_2 eq.

35	Emissions from combustion of waste from renewable sources used in production processes	0.3072	kg CO_2 eq.
36	Emissions from combustion of waste from non-renewable sources used in production processes	8.994	kg CO_2 eq.

b. produced at Nhon Trach Terminal

No	Core environmental impact indicators		
	Indicator	**A1-A3 (Total)**	**Unit**
1	Global Warming Potential total	966.8	kg CO_2 eq.
2	Global Warming Potential fossil fuels	966.6	kg CO_2 eq.
3	Global Warming Potential biogenic	0.1128	kg CO_2 eq.
4	Global Warming Potential land use and land use change	0.1104	kg CO_2 eq.
5	Depletion potential of the stratospheric ozone layer	1.26E-05	kg CFC 11 eq.
6	Acidification potential, Accumulated Exceedance	3.715	mol H+ eq.
7	Eutrophication potential, fraction of nutrients reaching freshwater end compartment	0.6545	kg PO_4 eq.
8	Eutrophication potential, fraction of nutrients reaching freshwater end compartment*	0.2135	kg P eq.
9	Eutrophication potential, fraction of nutrients reaching marine end compartment	1.35E-02	kg N eq.
10	Eutrophication potential, Accumulated Exceedance	7.783	mol N eq.
11	Formation potential of tropospheric ozone	1.902	kg NMVOC eq.
12	Abiotic depletion potential for non- fossil resources	2.41E-04	kg Sb eq.
13	Abiotic depletion for fossil resources potential	5183	MJ, net calorific value
14	Water (user) deprivation potential, deprivation-weighted water consumption	103.7	m^3 world eq. deprived
	Additional environmental impact indicators		
15	Potential incidence of disease due to PM emissions	2.37E-05	Disease incidence
16	Potential Human exposure efficiency relative to U235	8380	kBq U235 eq.
17	Potential Comparative Toxic Unit for ecosystems	113.3	CTUe
18	Potential Comparative Toxic Unit for humans - cancer	2.09E-06	CTUh
19	Potential Comparative Toxic Unit for humans - non-cancer	5.60E-05	CTUh
20	Potential soil quality index	2103	dimensionless
	Parameters describing resource use		
21	Use of renewable primary energy excluding renewable primary energy resources used as raw materials	261.5	MJ, net calorific value
22	Use of renewable primary energy resources used as raw materials	0	MJ, net calorific value
23	Total use of renewable primary energy resources	261.5	MJ, net calorific value

24	Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	5587	MJ, net calorific value
25	Use of non-renewable primary energy resources used as raw materials	0	MJ, net calorific value
26	Total use of non-renewable primary energy resources	5587	MJ, net calorific value
27	Use of secondary materials	98.11	kg
28	Use of renewable secondary fuels	112.7	MJ, net calorific value
29	Use of non-renewable secondary fuels	121	MJ, net calorific value
30	Net use of fresh water	2.489	m^3
	Other environmental information describing waste categories		
31	Hazardous waste disposed	1.50E-02	kg
32	Non-hazardous waste disposed	3.155	kg
33	Radioactive waste disposed	0	kg
	Extra indicators		
34	Emissions from calcination and removals from carbonation	451.5	kg CO_2 eq.
35	Emissions from combustion of waste from renewable sources used in production processes	0.112	kg CO_2 eq.
36	Emissions from combustion of waste from non-renewable sources used in production processes	12.76	kg CO_2 eq.

2.4.6 For Cement product: *Impact categories considered, as per the PCR 1000 kg average* ***INSEE Easy Flow Cement & INSEE Quick Cast***

a. Produced at Hon Chong Plant

No	Core environmental impact indicators		
	Indicator	**A1-A3 (Total)**	**Unit**
1	Global Warming Potential total	747.3	kg CO_2 eq.
2	Global Warming Potential fossil fuels	747.2	kg CO_2 eq.
3	Global Warming Potential biogenic	6.79E-02	kg CO_2 eq.
4	Global Warming Potential land use and land use change	7.51E-02	kg CO_2 eq.
5	Depletion potential of the stratospheric ozone layer	7.63E-06	kg CFC 11 eq.
6	Acidification potential, Accumulated Exceedance	2.133	mol H+ eq.
7	Eutrophication potential, fraction of nutrients reaching freshwater end compartment	0.3569	kg PO_4 eq.
8	Eutrophication potential, fraction of nutrients reaching freshwater end compartment*	0.1164	kg P eq.
9	Eutrophication potential, fraction of nutrients reaching marine end compartment	7.62E-03	kg N eq.
10	Eutrophication potential, Accumulated Exceedance	7.057	mol N eq.

11	Formation potential of tropospheric ozone	1.78	kg NMVOC eq.
12	Abiotic depletion potential for non- fossil resources	1.40E-04	kg Sb eq.
13	Abiotic depletion for fossil resources potential	3035	MJ, net calorific value
14	Water (user) deprivation potential, deprivation-weighted water consumption	46.67	m^3 world eq. deprived
	Additional environmental impact indicators		
15	Potential incidence of disease due to PM emissions	1.22E-05	Disease incidence
16	Potential Human exposure efficiency relative to U235	5378	kBq U235 eq.
17	Potential Comparative Toxic Unit for ecosystems	38.23	CTUe
18	Potential Comparative Toxic Unit for humans - cancer	3.16E-04	CTUh
19	Potential Comparative Toxic Unit for humans - non-cancer	7.83E-06	CTUh
20	Potential soil quality index	1184	dimensionless
	Parameters describing resource use		
21	Use of renewable primary energy excluding renewable primary energy resources used as raw materials	166.4	MJ, net calorific value
22	Use of renewable primary energy resources used as raw materials	0	MJ, net calorific value
23	Total use of renewable primary energy resources	166.4	MJ, net calorific value
24	Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	3281	MJ, net calorific value
25	Use of non-renewable primary energy resources used as raw materials	0	MJ, net calorific value
26	Total use of non-renewable primary energy resources	3281	MJ, net calorific value
27	Use of secondary materials	133.6	kg
28	Use of renewable secondary fuels	67.63	MJ, net calorific value
29	Use of non-renewable secondary fuels	66.03	MJ, net calorific value
30	Net use of fresh water	1.368	m^3
	Other environmental information describing waste categories		
31	Hazardous waste disposed	1.35E-02	kg
32	Non-hazardous waste disposed	224.4	kg
33	Radioactive waste disposed	0	kg
	Extra indicators		
34	Emissions from calcination and removals from carbonation	386.2	kg CO_2 eq.
35	Emissions from combustion of waste from renewable sources used in production processes	8.87E-02	kg CO_2 eq.
36	Emissions from combustion of waste from non-renewable sources used in production processes	9.344	kg CO_2 eq.

b. Produced at Thi Vai Terminal

No	Core environmental impact indicators		
	Indicator	**A1-A3 (Total)**	**Unit**
1	Global Warming Potential total	782.8	kg CO_2 eq.
2	Global Warming Potential fossil fuels	782.6	kg CO_2 eq.
3	Global Warming Potential biogenic	9.26E-02	kg CO_2 eq.
4	Global Warming Potential land use and land use change	8.64E-02	kg CO_2 eq.
5	Depletion potential of the stratospheric ozone layer	1.04E-05	kg CFC 11 eq.
6	Acidification potential, Accumulated Exceedance	2.87	mol H+ eq.
7	Eutrophication potential, fraction of nutrients reaching freshwater end compartment	0.4823	kg PO_4 eq.
8	Eutrophication potential, fraction of nutrients reaching freshwater end compartment*	0.1573	kg P eq.
9	Eutrophication potential, fraction of nutrients reaching marine end compartment	9.99E-03	kg N eq.
10	Eutrophication potential, Accumulated Exceedance	6.54	mol N eq.
11	Formation potential of tropospheric ozone	1.632	kg NMVOC eq.
12	Abiotic depletion potential for non- fossil resources	1.82E-04	kg Sb eq.
13	Abiotic depletion for fossil resources potential	3981	MJ, net calorific value
14	Water (user) deprivation potential, deprivation-weighted water consumption	73.9	m^3 world eq. deprived
	Additional environmental impact indicators		
15	Potential incidence of disease due to PM emissions	1.86E-05	Disease incidence
16	Potential Human exposure efficiency relative to U235	6657	kBq U235 eq.
17	Potential Comparative Toxic Unit for ecosystems	82.95	CTUe
18	Potential Comparative Toxic Unit for humans - cancer	6.74E-05	CTUh
19	Potential Comparative Toxic Unit for humans - non-cancer	3.80E-05	CTUh
20	Potential soil quality index	1530	dimensionless
	Parameters describing resource use		
21	Use of renewable primary energy excluding renewable primary energy resources used as raw materials	178.7	MJ, net calorific value
22	Use of renewable primary energy resources used as raw materials	0	MJ, net calorific value
23	Total use of renewable primary energy resources	178.7	MJ, net calorific value
24	Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	4291	MJ, net calorific value

25	Use of non-renewable primary energy resources used as raw materials	0	MJ, net calorific value
26	Total use of non-renewable primary energy resources	4291	MJ, net calorific value
27	Use of secondary materials	190.1	kg
28	Use of renewable secondary fuels	87.66	MJ, net calorific value
29	Use of non-renewable secondary fuels	92.74	MJ, net calorific value
30	Net use of fresh water	1.808	m^3
	Other environmental information describing waste categories		
31	Hazardous waste disposed	1.12E-02	kg
32	Non-hazardous waste disposed	22.02	kg
33	Radioactive waste disposed	0	kg
	Extra indicators		
34	Emissions from calcination and removals from carbonation	375.4	kg CO_2 eq.
35	Emissions from combustion of waste from renewable sources used in production processes	9.17E-02	kg CO_2 eq.
36	Emissions from combustion of waste from non-renewable sources used in production processes	10.28	kg CO_2 eq.

c. Produced at HIEP PHUOC Terminal

No	Core environmental impact indicators		
	Indicator	**A1-A3 (Total)**	**Unit**
1	Global Warming Potential total	743	kg CO_2 eq.
2	Global Warming Potential fossil fuels	742.8	kg CO_2 eq.
3	Global Warming Potential biogenic	6.42E-02	kg CO_2 eq.
4	Global Warming Potential land use and land use change	7.08E-02	kg CO_2 eq.
5	Depletion potential of the stratospheric ozone layer	7.50E-06	kg CFC 11 eq.
6	Acidification potential, Accumulated Exceedance	2.202	mol H+ eq.
7	Eutrophication potential, fraction of nutrients reaching freshwater end compartment	0.3722	kg PO_4 eq.
8	Eutrophication potential, fraction of nutrients reaching freshwater end compartment*	0.1214	kg P eq.
9	Eutrophication potential, fraction of nutrients reaching marine end compartment	7.80E-03	kg N eq.
10	Eutrophication potential, Accumulated Exceedance	6.819	mol N eq.
11	Formation potential of tropospheric ozone	1.709	kg NMVOC eq.
12	Abiotic depletion potential for non- fossil resources	1.39E-04	kg Sb eq.
13	Abiotic depletion for fossil resources potential	3113	MJ, net calorific value
14	Water (user) deprivation potential, deprivation-weighted water consumption	36.43	m^3 world eq. deprived
	Additional environmental impact indicators		

15	Potential incidence of disease due to PM emissions	1.31E-05	Disease incidence
16	Potential Human exposure efficiency relative to U235	5122	kBq U235 eq.
17	Potential Comparative Toxic Unit for ecosystems	42.97	CTUe
18	Potential Comparative Toxic Unit for humans - cancer	2.66E-04	CTUh
19	Potential Comparative Toxic Unit for humans - non-cancer	1.31E-05	CTUh
20	Potential soil quality index	1202	dimensionless
	Parameters describing resource use		
21	Use of renewable primary energy excluding renewable primary energy resources used as raw materials	162.3	MJ, net calorific value
22	Use of renewable primary energy resources used as raw materials	0	MJ, net calorific value
23	Total use of renewable primary energy resources	162.3	MJ, net calorific value
24	Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	3359	MJ, net calorific value
25	Use of non-renewable primary energy resources used as raw materials	0	MJ, net calorific value
26	Total use of non-renewable primary energy resources	3359	MJ, net calorific value
27	Use of secondary materials	140.5	kg
28	Use of renewable secondary fuels	71.13	MJ, net calorific value
29	Use of non-renewable secondary fuels	70.83	MJ, net calorific value
30	Net use of fresh water	0.9787	m^3
	Other environmental information describing waste categories		
31	Hazardous waste disposed	8.82E-03	kg
32	Non-hazardous waste disposed	85.06	kg
33	Radioactive waste disposed	0	kg
	Extra indicators		
34	Emissions from calcination and removals from carbonation	381.9	kg CO_2 eq.
35	Emissions from combustion of waste from renewable sources used in production processes	8.88E-02	kg CO_2 eq.
36	Emissions from combustion of waste from non-renewable sources used in production processes	9.473	kg CO_2 eq.

2.4.7 For Cement product: *Impact categories considered, as per the PCR 1000 kg average* ***INSEE Slag Cement : INSEE Mass Pour, INSEE Extra Durable, INSEE Stable Soil, INSEE Compact Rock produced at Thi Vai Terminal***

No	Core environmental impact indicators		
	Indicator	**A1-A3 (Total)**	**Unit**
1	Global Warming Potential total	438.7	kg CO_2 eq.
2	Global Warming Potential fossil fuels	438.6	kg CO_2 eq.
3	Global Warming Potential biogenic	8.22E-02	kg CO_2 eq.
4	Global Warming Potential land use and land use change	8.37E-02	kg CO_2 eq.
5	Depletion potential of the stratospheric ozone layer	1.22E-05	kg CFC 11 eq.
6	Acidification potential, Accumulated Exceedance	2.054	mol H+ eq.
7	Eutrophication potential, fraction of nutrients reaching freshwater end compartment	0.33	kg PO_4 eq.
8	Eutrophication potential, fraction of nutrients reaching freshwater end compartment*	0.1076	kg P eq.
9	Eutrophication potential, fraction of nutrients reaching marine end compartment	6.98E-03	kg N eq.
10	Eutrophication potential, Accumulated Exceedance	3.804	mol N eq.
11	Formation potential of tropospheric ozone	1.091	kg NMVOC eq.
12	Abiotic depletion potential for non- fossil resources	1.41E-04	kg Sb eq.
13	Abiotic depletion for fossil resources potential	3012	MJ, net calorific value
14	Water (user) deprivation potential, deprivation-weighted water consumption	48.2	m^3 world eq. deprived
	Additional environmental impact indicators		
15	Potential incidence of disease due to PM emissions	1.28E-05	Disease incidence
16	Potential Human exposure efficiency relative to U235	6723	kBq U235 eq.
17	Potential Comparative Toxic Unit for ecosystems	62.35	CTUe
18	Potential Comparative Toxic Unit for humans - cancer	1.15E-06	CTUh
19	Potential Comparative Toxic Unit for humans - non-cancer	2.59E-05	CTUh
20	Potential soil quality index	1070	dimensionless
	Parameters describing resource use		
21	Use of renewable primary energy excluding renewable primary energy resources used as raw materials	165.8	MJ, net calorific value
22	Use of renewable primary energy resources used as raw materials	0	MJ, net calorific value
23	Total use of renewable primary energy resources	165.8	MJ, net calorific value
24	Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	3272	MJ, net calorific value

25	Use of non-renewable primary energy resources used as raw materials	0	MJ, net calorific value
26	Total use of non-renewable primary energy resources	3272	MJ, net calorific value
27	Use of secondary materials	697.7	kg
28	Use of renewable secondary fuels	38.65	MJ, net calorific value
29	Use of non-renewable secondary fuels	41.5	MJ, net calorific value
30	Net use of fresh water	1.207	m^3
	Other environmental information describing waste categories		
31	Hazardous waste disposed	1.00E-02	kg
32	Non-hazardous waste disposed	2.067	kg
33	Radioactive waste disposed	0	kg
	Extra indicators		
34	Emissions from calcination and removals from carbonation	154.9	kg CO_2 eq.
35	Emissions from combustion of waste from renewable sources used in production processes	3.84E-02	kg CO_2 eq.
36	Emissions from combustion of waste from non-renewable sources used in production processes	4.377	kg CO_2 eq.

2.5 Interpretation

The following table provides an identification of the most significant contributors to a selection of the parameters presented above:

Parameter	Most significant contributor
Primary energy demand	Dominated by the use of non-renewable energy and the corresponding supply chains. The most significant process using energy is the kiln.
Water demand	Dominated by the use of surface water related to the generation of electricity. The water use on site is less than 1% of the total freshwater use.
Waste generation	Waste in terms of material waste is generated in upstream processes fuel supply.
Global warming potential	The kiln causes about 89% of the greenhouse gas emissions. The use of clinker in the cement is the main cause for overall global warming potential. Emissions in the kiln result from both decarbonation of limestone as well as the burning of fuel.
Acidification potential	Dominated by sulphur dioxide emissions from the kiln and emissions from electricity production.
Eutrophication potential	The kiln is the major source for emission of nitrous oxides. Lignite production is another significant contributor.

Ozone depletion potential	Dominated by emissions from electricity production.
Photochemical ozone creation potential	Dominated by nitrous oxide and sulphur dioxide emissions from the kiln as well as from fuel production for the burning of clinker. Emissions from electricity production as further significant contributor.
ADP elements	Highest contribution associated with the quarry of gypsum
ADP fossil	Fossil fuel consumption is dominated by the supply and use of fossil fuels (diesel). Second largest contribution through the supply chain of electricity. Considered electricity mix for INSEE Vietnam.
Dust: PM10-equivalents	Generated by emissions from electricity production. PM 10 is the fraction of particulates in air of very small size (<10μm)
Risk poll: PM2,5-equivalents	Generated by emissions from electricity production in Romania. PM 2,5 is the fraction of particulates in air of very small size (<2,5μm)

TABLE 1.4: Most significant contributors to life cycle parameters

Concluding, the use of energy is the most significant contributor to environmental impacts associated with cement. Energy is used as electricity and fuel, by far dominated by the kiln. Also contributing is the energy demand related to the excavation of raw materials. The contribution to global warming (carbon emissions) is dominated by the decarbonation of clinker – a process necessary to produce cement.

2.6 Other environmental information

INSEE Vietnam, being aware of its responsibility as cement manufacturer towards the environment, and in particular on the limited natural resources has implemented as part of its integrated management system, an environmental management system. Thus, all the activities that could have a significant impact on the environment are kept under control. Also, we ensure that 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.

In this sense, we measure, monitor, assess and continuously improve our environmental performances. We prevent environmental pollution by implementing in our operations the best available technology and by maintaining and operating our installations in optimum ways. 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. INSEE is promoting in Vietnam the reduction, recycling and recovering of waste and the optimization of water consumption in all processes.

More information regarding our environmental and responsibly sourcing objectives and activities are available on http://insee.com.vn/en/phat-trien-ben-vung/gioi-thieu-sd

Report standards

We refer to GRI standards in our annual SD report follow the Global reporting Initiative (GRI) Guideline - https://insee.com.vn/INSEE_SD_report.pdf

INSEE VN has joined to the program "Benchmarking and Announcing Sustainable Companies in Vietnam" that organized annually by The Vietnam Business Council for Sustainable Development (VBCSD) to rate the Sustainability performance for private sector in VN with the name of CSI (Corporate Sustainability Index) with this link : http://en.vbcsd.vn/csi.asp

REFERENCES

EN 15804:2012+A2:2019, Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products.

PCR 2019:14 Construction products and services, the construction product PCR based on EN 15804:A2

ISO 14040:2006 Environmental management – Life cycle assessment – Principles and framework

ISO 14044: 2006 Environmental management -- Life cycle assessment -- Requirements and guidelines

ISO 14025: 2006 Environmental labels and declarations - Type III environmental declarations - Principles and procedures

The terms A1 – A3 refer to the specific modules in the EN 15804 standard, essentially this means that the information in this EPD is for the 'cradle to gate' part of the life cycle.

Global Cement and Concrete Association (GCCA) - The Cement CO_2 and Energy Protocol, V3 CO_2 and Energy Accounting and Reporting Standard for the Cement Industry

ISO 9001:2018 Quality Management Systems

ISO 14001:2018 Environmental Management System

ISO 50001:2018 Energy Management System (EnMS)

ISO 45001:2018 Health and Safety Management System (SMS)

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