TCI SANMAR CHEMICALS S.A.E.

TCI SANMAR CHEMICALS S.A.E

PVC SUSPENSION RESIN

ENVIRONMENTAL PRODUCT DECLARATION

Programme: The International EPD® System, www.environdec.com
Programme operator: EPD International AB
EPD registration number: S-P-05698
Publication date: 2022-05-03
Valid until: 2027-05-02
Geographical scope: World

An EPD should provide current information and may be updated if conditions change. The stated validity is therefore subject to the continued

GENERAL INFORMATION

MANUFACTURER INFORMATION

Manufacturer EPD-008	**TCI Sanmar Chemicals SAE**
Address	Industrial Area C9 South EL Raswa- South Port Said – Egypt.
Contact details	MHH1T@tci.sanmargroup.com
Website	http://www.sanmargroup.com/tci.php

PRODUCT IDENTIFICATION

Product name	**PVC Suspension Resin**
Product number / reference	120900
Place(s) of production	Port Said, Egypt
CPC code	34710 - Polymers of ethylene, in primary forms

The International EPD System

EPDs within the same product category but from different programmes may not be comparable.

EPD INFORMATION

The EPD owner has the sole ownership, liability, and responsibility for the EPD. Construction products EPDs may not be comparable if they do not comply with EN 15804 and if they are not compared in a building context.

EPD program operator	**The International EPD System**
EPD standards	This EPD is in accordance with EN 15804+A2 and ISO 14025 standards.
Product category rules	The CEN standard EN 15804 serves as the core PCR. In addition, the Int'l EPD System PCR 2019:14 Construction products, version 1.11 (05.02.2021) is used.
EPD author	Dr. Nasser Ayoub, DCarbon Egypt
EPD verification	Independent verification of this EPD and data, according to ISO 14025: ☐ Internal certification ☑ External verification
Verification date	2022-05-02
EPD verifier	Elisabet Amat
EPD number	S-P-05698
Publishing date	2022-05-03
EPD valid until	2027-05-02

PRODUCT INFORMATION

PRODUCT DESCRIPTION

Poly Vinyl Chloride Resin is thermoplastic resin which can be softened on reheating. It is available in powder form.

PRODUCT APPLICATION

PVC (poly vinyl chloride) is the main raw material for rigid and flexible plastics which are widely used in construction for pipes, profile application and cable insulation.

TECHNICAL SPECIFICATIONS

Sample ID	Item Analysis	Unit	TCI Limit	Test method
PVC resin	K-value		67+/- 1	INEOS PM01
	Heat loss (moisture)	%	Max. 0.3	ASTM D 3030
	APS < 63 um (230 mesh)	%	Max 5%	ASTM D1921
(Product K6701)	APS > 250 um (60 mesh)	%	Max 5%	ASTM D1921
	Bulk Density	g/ml	0.49-0.54	ASTM D1895
	Dark resin (in 100 gm)	count	25 max	INEOS PM06

PHYSICAL PROPERTIES OF THE PRODUCT

Property	PVC Resin
APPEARANCE	White powder
ODOR	Odourless
pH at 20°C	N/A-Solid
BOILING POIN	N/A
MELTING POINT	N/A
FLASH POINT	N/A
IGNITION TEMPERATURE	> 387°C
MOLECULAR WEIGHT	30,000-150,000 g/mol
VAPOUR PRESSURE	<1 mmHg
BULK DENSITY	0.49 – 0.56 g/ml
VAPOUR DENSITY	N/A (air = 1)
SPECIFIC GRAVITY	1.39
INHERENT VISCOSITY	0.9 – 0.94
% VOLATILE	100%
POROSITY	0.20 – 0.32 ml/g w/w
SOLUBILITY	Insoluble in water; soluble in THF, Cyclohexanone

ADDITIONAL TECHNICAL INFORMATION

Further information can be found at http://www.sanmargroup.com/tci.php

PRODUCT RAW MATERIAL COMPOSITION

Material	Weight, kg	Post consumer %	Renewable %	Country / Region of origin
Salt	29.14	-	-	Egypt
Ethanol	175.02	-	-	Egypt
Ethylene Dichloride	773.29	-	-	US, DE, ZA, GB
Water	22.55	-	-	Egypt
Packaging Materials				
Wooden Pallet	29.62	-	-	Egypt
PP Jumbo Bag	4.00	-	-	Egypt
PP Open Bag	5.60	-	-	Egypt
LDPE Sheet	0.34	-	-	Egypt
Filler Cord	0.07		-	Egypt
Plastic Pallet	0.01	-	-	Egypt
PVC Cable Tie	0.042	-	-	Egypt

SUBSTANCES, REACH - VERY HIGH CONCERN

The product does not contain any REACH SVHC substances in amounts greater than 0,1 % (1000 ppm).

PRODUCT LIFE-CYCLE

MANUFACTURING AND PACKAGING (A1-A3)

Raw material supply: A1

The environmental impacts of raw material supply include emissions generated when raw materials are taken from nature, transported to industrial units for processing and processed, along with waste handling from the various production processes. All major upstream processes are taken into consideration. This stage includes all raw materials which end up in the final products. The main raw material for PVC Resins is Chlorine, EDC, Ethanol and Ethylene. However, a special aspect about the production of ethylene in this process is that it is produced from condensation of ethanol which is made from the fermentation of crops unlike the thermal cracking of crude oils. Negligible amounts ancillary materials are used in PVC Production that are excluded in the cut off and not detailed here.

Transport: A2

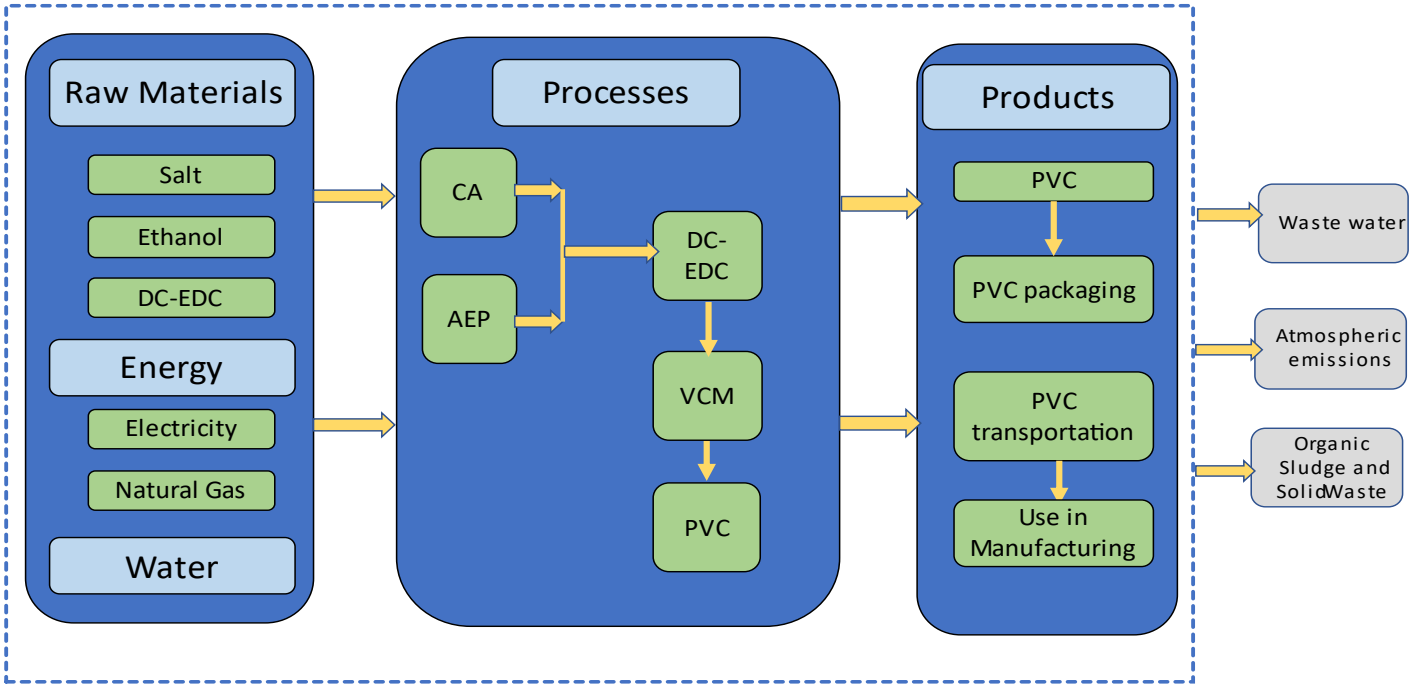
The considered transportation impacts include exhaust emissions resulting from transportation of raw materials from suppliers to manufacturing facilities as well as the environmental impacts of the production of the diesel used. The manufacturing, maintenance, and disposal of the vehicles as well as tyre and road wear during transportation have also been included from the databases. The transportation distances were calculated based on information provided by the Manufacturer.

Manufacturing A3

The environmental impacts considered for the production stage cover all materials including packaging materials and ancillary materials. Also, fuels used by machines, as well as handling of waste formed in the production processes at the manufacturing facilities are included in this stage. The study considers also the losses occurring during the manufacturing processes.
The process of making PVC Resins, shown in the flowchart, starts by converting the Salt via Electrical Electrolysis to Chlorine and Caustic Soda. Caustic Soda solution produced at 50% concentration. Almost 40% of the Chlorine produced is converted to Ethylene Dichloride by reaction with in-house produced Ethylene. The Ethylene is produced in-house via the catalytic dehydration of Ethanol to produce Ethylene with more than 99% conversion rate of ethanol.

The Vinyl Chloride Monomer (VCM) is then produced from the Ethylene Di Chloride. In PVC plant, PVC is produced by the suspension polymerization reaction for the VCM in reactors equipped with agitator and jacket cooling system. The VCM is charged to the reactor together in batch process with water and catalyst plus chemical additives to control the PVC quality and after the reaction complete The PVC is discharged from the reactor as a slurry (30% PVC + 70% Water) which is stripped for the removal of the any residual VCM down to 1 ppm in a steam stripping column then dried in two stages, the first one by centrifugal force and the second one by fluidized bed dryer. The unconverted VCM is recovered in the recovery section and stored in RVCM tank to be charged to the reactor again.

Manufacturing process



Acronym	Full Name
DC-EDC	Direct Chlorination – Ethylene Dichloride Unit
CA	Chlori-Alkai plant (Brine Electrolysis)
AEP	Ethylene Production
VCM	Vinyl Chloride Monomer
PVC	Polyvinyl Production

TRANSPORT AND INSTALLATION (A4-A5)

Transportation to use site: A4

The transportation distance is defined according to the PCR. Average distance of transportation from TCI Sanmar plant to use site is assumed as 150 km and the transportation method is assumed to be lorry. Vehicle capacity utilization volume factor is assumed to be 100 which means full load. In reality, it may vary but as role of transportation emissions in total results is small, the variety in load is assumed to be negligible. Empty returns are not taken into account as it is assumed that return trip is used by the transportation company to serve the needs of other clients. Transportation does not cause losses as product are packaged properly. Also, volume capacity utilization factor is assumed to be 100 for the nested packaged products.

Installation into the building: A5

As the PVC Resins are used to produce construction materials, the environmental impacts from installation into the building (A5) is only limited to the generation and treatment of waste at the construction site.

PRODUCT USE AND MAINTENANCE (B1-B7) and PRODUCT END OF LIFE (C1-C4, D)

This EPD does not cover the use phase or the end-of-life phase. Air soil, and water impacts during the use phase and the end-of-life phase have not been studied.

LIFE-CYCLE ASSESSMENT

LIFE-CYCLE ASSESSMENT INFORMATION

Period for data	**April 2019 - March 2020**

DECLARED UNIT

Declared unit	**1 ton of PVC Resins**
Mass per declared unit	1000 kg

BIOGENIC CARBON CONTENT

Product's biogenic carbon content at the factory gate

Biogenic carbon content in product, kg C	**0**
Biogenic carbon content in packaging, kg C	13.336

SYSTEM BOUNDARY

This EPD covers the *cradle to gate with options* scope with following modules; A1 (Raw material supply), A2 (Transport) and A3 (Manufacturing), A4 (Transport), A5 (Assembly).

Product stage			Assembly stage		Use stage							End of life stage				Beyond the system boundaries		
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D	D	D
x	x	X	x	x	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND
Geography, by two-letter ISO country code or regions. The International EPD System only.																		
EG	EG	EG	EG	EG	-	-	-	-	-	-	-	-	-	-	-	-		
Raw materials	Transport	Manufacturing	Transport	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstr./demol.	Transport	Waste processing	Disposal	Reuse	Recovery	Recycling

Modules not declared = MND. Modules not relevant = MNR. x= module is included in the study

Cut-OFF CRITERIA

The study does not exclude any modules or processes which are stated mandatory in the EN 15804:2012+A2:2019 and the applied PCR. The study does not exclude any hazardous materials or substances.

The study includes all major raw material and energy consumption. All inputs and outputs of the unit processes, for which data is available for, are included in the calculation. There is no neglected unit process more than 1% of total mass or energy flows. The module specific total neglected input and output flows also do not exceed 5% of energy usage or mass.

ALLOCATION, ESTIMATES AND ASSUMPTIONS

Allocation is required if some material, energy, and waste data cannot be measured separately for the product under investigation. In this study, as per EN 15804, allocation is conducted in the following order;

1. Allocation should be avoided.
2. Allocation should be based on physical properties (e.g., mass, volume) when the difference in revenue is small.
3. Allocation should be based on economic values.

Allocation used in Ecoinvent 3.6 environmental data sources follows the methodology 'allocation, cut-off by classification'. This methodology is in line with the requirements of the EN 15804 -standard.

ENVIRONMENTAL IMPACT DATA

Note: additional environmental impact data may be presented in annexes.

CORE ENVIRONMENTAL IMPACT INDICATORS – EN 15804+A2

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5
GWP – total	kg CO_2e	1,08E3	1,17E2	7,18E2	1,91E3	6,53E0	5,35E1
GWP – fossil	kg CO_2e	1,26E3	1,17E2	7,67E2	2,14E3	6,59E0	1,63E0
GWP – biogenic	kg CO_2e	-2,33E2	-8,92E-3	-4,99E1	-2,83E2	4,78E-3	5,19E1
GWP – LULUC	kg CO_2e	5,44E1	6,93E-2	1,39E-1	5,46E1	1,98E-3	2,33E-4
Ozone depletion pot.	kg CFC_{-11}e	3,81E-4	2,43E-5	7,02E-5	4,76E-4	1,55E-6	1,38E-7
Acidification potential	mol H^+e	8,06E0	3,05E0	2,4E0	1,35E1	2,77E-2	3,79E-3
EP-freshwater[2)]	kg Pe	7,7E-2	6,46E-4	5,69E-3	8,33E-2	5,36E-5	9,06E-6
EP-marine	kg Ne	1,91E0	7,65E-1	5,32E-1	3,2E0	8,34E-3	2,35E-3
EP-terrestrial	mol Ne	2,06E1	8,5E0	5,34E0	3,44E1	9,21E-2	1,4E-2
POCP ("smog")	kg NMVOCe	4,22E0	2,22E0	1,59E0	8,04E0	2,96E-2	5,01E-3
ADP-minerals & metals	kg Sbe	3,89E-2	1,13E-3	8,75E-4	4,09E-2	1,12E-4	5,11E-6
ADP-fossil resources	MJ	2,55E4	1,57E3	1,19E4	3,9E4	1,02E2	1,05E1
Water use[1)]	m^3e depr.	1,83E3	4,1E0	2,42E2	2,08E3	3,81E-1	4,44E-1

1) GWP = Global Warming Potential; EP = Eutrophication potential; POCP = Photochemical ozone formation; ADP = Abiotic depletion potential. 2) EN 15804+A2 disclaimer for Abiotic depletion and Water use and optional indicators except Particulate matter and Ionizing radiation, human health. The results of these environmental impact indicators shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator. 3) Required characterisation method and data are in kg P-eq. Multiply by 3,07 to get PO_4e.

ADDITIONAL (OPTIONAL) ENVIRONMENTAL IMPACT INDICATORS – EN 15804+A2

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5
Particulate matter	Incidence	6,16E-5	5,64E-6	1,64E-5	8,36E-5	5,96E-7	7,22E-8
Ionizing radiation[3)]	kBq U235e	3,4E1	6,73E0	1,11E1	5,19E1	4,48E-1	4,12E-2
Ecotoxicity	CTUe	8,03E4	1,05E3	4,74E3	8,61E4	7,83E1	1,03E1
Human toxicity, cancer	CTUh	2,76E-6	6,13E-8	1,38E-7	2,96E-6	2E-9	2,84E-10
Human tox. non-	CTUh	8,62E-5	1,01E-6	2,47E-6	8,96E-5	9,28E-8	1,02E-8
SQP	-	2,32E3	6,77E2	1,92E2	3,19E3	1,55E2	3,59E1

4) SQP = Land use related impacts/soil quality.5) EN 15804+A2 disclaimer for Ionizing radiation, human health. This impact category deals mainly with the eventual impact of low dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator.

USE OF NATURAL RESOURCES

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5
Renew. PER as energy	MJ	8,5E3	1,27E1	5,05E2	9,02E3	1,29E0	1,81E-1
Renew. PER as material	MJ	0E0	0E0	4,7E2	4,7E2	0E0	0E0
Total use of renew. PER	MJ	8,5E3	1,27E1	9,75E2	9,49E3	1,29E0	1,81E-1
Non-re. PER as energy	MJ	1,42E4	1,57E3	1,14E4	2,72E4	1,02E2	1,05E1
Non-re. PER as material	MJ	1,13E4	0E0	4,78E2	1,17E4	0E0	0E0
Total use of non-re. PER	MJ	2,55E4	1,57E3	1,19E4	3,9E4	1,02E2	1,05E1
Secondary materials	kg	5,37E0	0E0	1,79E-1	5,55E0	0E0	0E0
Renew. secondary fuels	MJ	0E0	0E0	-8,08E2	-8,08E2	0E0	0E0
Non-ren. secondary fuels	MJ	0E0	0E0	0E0	0E0	0E0	0E0
Use of net fresh water	m^3	4,91E1	1,97E-1	4,44E0	5,37E1	2,13E-2	1,12E-2

6) PER = Primary energy resources

END OF LIFE – WASTE

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5
Hazardous waste	kg	1,1E2	1,8E0	8,6E0	1,2E2	9,95E-2	1,86E-2
Non-hazardous waste	kg	2,15E3	6,36E1	1,9E2	2,4E3	1,1E1	3,97E1
Radioactive waste	kg	2,5E-2	1,09E-2	1,55E-2	5,13E-2	7,03E-4	6,3E-5

ENVIRONMENTAL IMPACTS – GWP-GHG - THE INTERNATIONAL EPD SYSTEM

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5
GWP-GHG	kg	1,26E	1,17E2	7,67E	2,14E	6,59	1,63E

8) This indicator includes all greenhouse gases excluding biogenic carbon dioxide uptake and emissions and biogenic carbon stored in the product as defined by IPCC AR 5 (IPCC 2013) This indicator Is almost equal to the GWP indicator originally defined in EN 15804:2012+A1:2013.

SCENARIO DOCUMENTATION

Manufacturing energy scenario documentation

Scenario parameter	Value
Electricity data source and quality	Electricity grid mix profile based on BUR, Egypt. 2018
Electricity CO_2e / kWh	0.6
District heating data source and quality	-
District heating CO_2e / kWh	-

BIBLIOGRAPHY

ISO 14025:2010 Environmental labels and declarations – Type III environmental declarations. Principles and procedures.

ISO 14040:2006 Environmental management. Life cycle assessment. Principles and frameworks.

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

Ecoinvent database v3.6 (2019) and One Click LCA database.

Egypt's first Biennial Update Report for to the UNFCC. Cairo: Ministry of Environment, Egyptian Environmental Affairs Agency. (2018)

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

Int'l EPD System PCR 2019:14 Construction products, version 1.11 (05.02.2021)

General Programme Instructions of the international EPD® system. Version 4.0

PVC Suspension Resin LCA background report 05.02.2022

ABOUT THE MANUFACTURER

The Sanmar Group is the largest Indian investor in Egypt — through a 100% owned company, namely TCI Sanmar Chemicals S.A.E., with its state-of-the-art chemical manufacturing facilities located at Port Said. The Group's journey in Egypt started 2007.

TCI Sanmar has so far invested around USD 1.5 Billion to create world class facilities that produce 275,000 Ton of Caustic Soda, 400,000 Ton of Poly Vinyl Chloride (PVC) and 135,000 Ton of Calcium Chloride Granules and 60,000 Ton of Green Ethylene every year. These capacities are the biggest thus far in the entire MENA region. TCI Sanmar also operates a Zero Liquid Discharge plant, the first of its kind in Egypt.

Besides providing direct and indirect employment to around 3000 persons, the company's products sold in the domestic market substitute imports and thus save foreign exchange outgo substantially. Also export of both Caustic Soda and PVC (and Calcium Chloride granules in future) will fetch much needed dollar inflow for the country. Further, true to its role of a responsible corporate citizen, TCI Sanmar Chemicals involve itself in a number of CSR activities, thus playing a positive role in the economic upliftment of Port Said.

TCI Sanmar implements and maintains the Environment Management System according to the ISO 14001:2015 standards in all operations and activities (Awarded ISO 14001 certificate in May 2019). Also, the company implements and maintains the Occupational Safety and Health Management System according to the ISO 18001:2007 standards in all operations and activities (Awarded ISO 18001 certificate in May 2019). In addition, TCI Sanmar implements and maintains the Quality Management System according to the ISO 9001:2015 standards in all operations and activities and was awarded ISO 9001 certificate in May 2019. For more information, you can access our website here: http://www.sanmargroup.com/tci.php.

EPD AUTHOR AND CONTRIBUTORS

Manufacturer	TCI Sanmar Chemicals SAE
EPD author	Dr. Nasser Ayoub, DCarbon Egypt
EPD verifier	Elisabet Amat
EPD program operator	The International EPD System
Background data	This EPD is based on Ecoinvent 3.6 (cut-off) and One Click LCA databases.
LCA software	The LCA and EPD have been created using One Click LCA Flexible EPD Generator for Plastic-based Products and Systems

VERIFICATION STATEMENT

VERIFICATION PROCESS FOR THIS EPD

This EPD has been verified in accordance with ISO 14025 by an independent, third-party verifier by reviewing results, documents and compliancy with EN 15804, ISO 14025 and ISO 14040/14044, following the process and checklists of the program operator for:

- This Environmental Product Declaration
- The Life-Cycle Assessment used in this EPD
- The background report (project report) for this EPD

Why does verification transparency matter? Read more online.

VERIFICATION OVERVIEW

Following independent third party has verified this specific EPD:

EPD verification information	Answer
Independent EPD verifier	Elisabet Amat
EPD verification started on	2022-03-16
EPD verification completed	2022-05-02
Supply-chain specific data	91%
Approver of the EPD verifier	The International EPD System

Author & tool verification	Answer
EPD author	Dr. Nasser Ayoub, DCarbon Egypt
EPD author training	2021-10-26

THIRD-PARTY VERIFICATION STATEMENT

I hereby confirm that, following detailed examination, I have not established any relevant deviations by the studied Environmental Product Declaration (EPD), its LCA and project report, in terms of

- the data collected and used in the LCA calculations,
- the way the LCA-based calculations have been carried out,
- the presentation of environmental data in the EPD, and
- other additional environmental information, as present

with respect to the procedural and methodological requirements in ISO 14025:2010 and EN 15804:2012+A2:2019.

I confirm that the company-specific data has been examined as regards plausibility and consistency; the declaration owner is responsible for its factual integrity and legal compliance.

I confirm that I have sufficient knowledge and experience of construction products, this specific product category, the construction industry, relevant standards, and the geographical area of the EPD to carry out this verification.

I confirm my independence in my role as verifier; I have not been involved in the execution of the LCA or in the development of the declaration and have no conflicts of interest regarding this verification

Elisabet Amat, Individual Verifier

VERIFICATION AND REGISTRATION (ENVIRONDEC)

ISO standard ISO 21930 and CEN standard EN 15804 serves as the core Product Category Rules (PCR)	
PCR	PCR 2019:14 Construction products, version 1.11
PCR review was conducted by:	The Technical Committee of the International EPD® System. See www.environdec.com/TC for a list of members. Review chair: Claudia A. Peña, University of Concepción, Chile. The review panel may be contacted via the Secretariat www.environdec.com/contact.
Independent third-party verification of the declaration and data, according to ISO 14025:2006:	Independent verification of this EPD and data, according to ISO 14025: ☐ Internal certification ☑ External verification
Third party verifier	Elisabet Amat
	Approved by: The International EPD® System Technical Committee, supported by the Secretariat
Procedure for follow-up during EPD validity involves third party verifier	☐ yes ☑ no

EPD®

THE INTERNATIONAL EPD® SYSTEM

EPD International AB, Box 210 60, SE-100 31 Stockholm, Sweden, E-mail: info@environdec.com

ANNEX 1 : environmental impacts – en 15804+A1, cml / iso 21930

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5
Global Warming	kg CO_2e	1,25E3	1,16E2	7,46E2	2,12E3	6,53E0	2,62E0
Ozone depletion	kg $CFC_{-11}e$	6,03E-4	1,92E-5	5,5E-5	6,78E-4	1,23E-6	1,1E-7
Acidification	kg SO_2e	6,31E0	2,41E0	1,93E0	1,06E1	1,34E-2	2,7E-3
Eutrophication	kg PO_4^3e	2,39E0	2,79E-1	3,12E-1	2,98E0	2,71E-3	1,22E-1
POCP (“smog”)	kg C_2H_4e	2,79E-1	6,4E-2	1,09E-1	4,52E-1	8,49E-4	6,87E-4
ADP-elements	kg Sbe	3,89E-2	1,13E-3	8,74E-4	4,09E-2	1,12E-4	5,11E-6
ADP-fossil	MJ	2,55E4	1,57E3	1,19E4	3,9E4	1,02E2	1,05E1