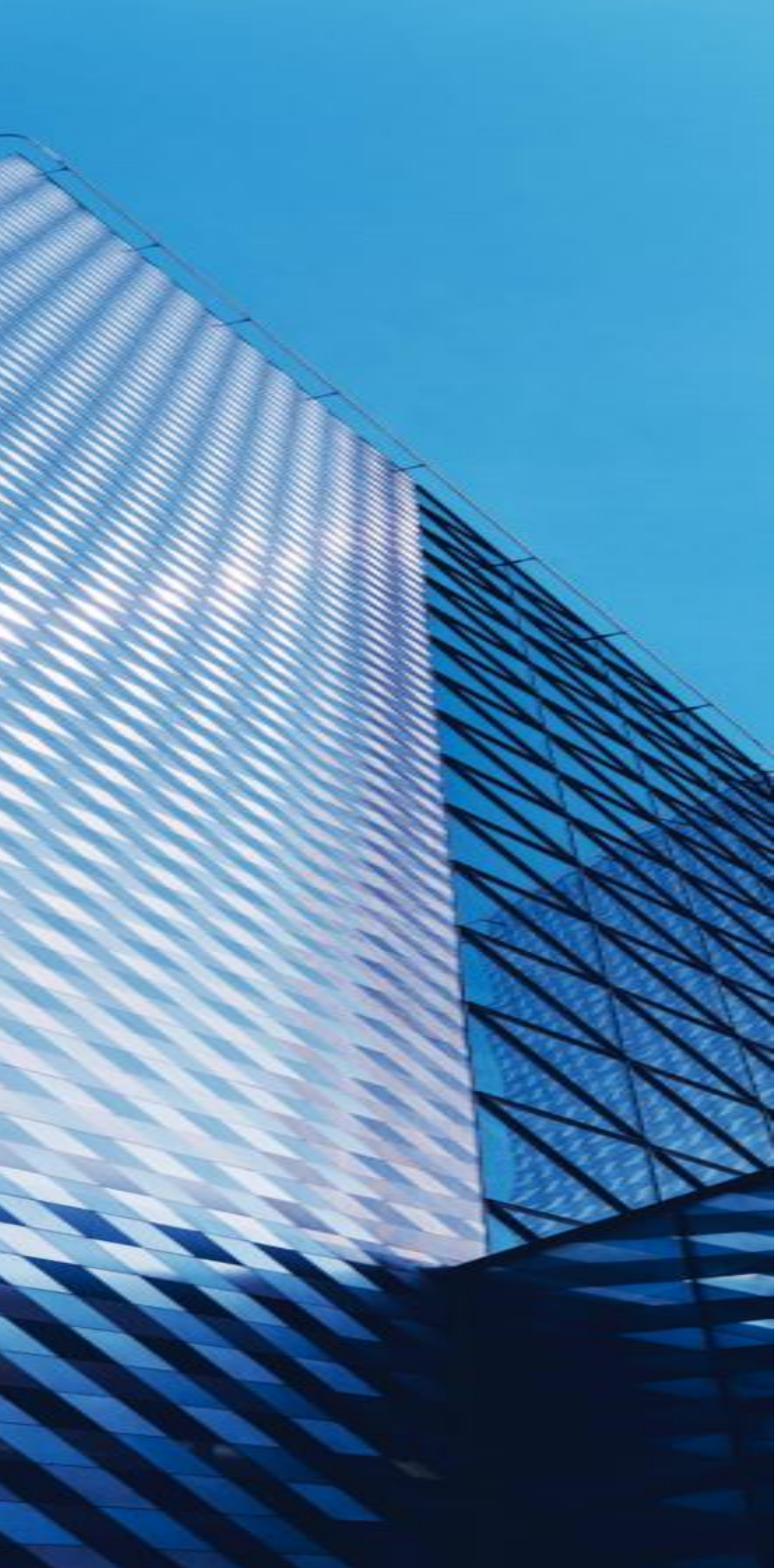


ENVIRONMENTAL PRODUCT DECLARATION

IN ACCORDANCE WITH EN 15804+A2 & ISO 14025 / ISO 21930

TerraClass® reinforced by steel

Tierra Armada

EPD HUB, HUB-1277

Published on 03.04.2024, last updated on 03.04.2024, valid until 03.04.2029.

Created with One Click LCA

GENERAL INFORMATION

MANUFACTURER

Manufacturer	Tierra Armada
Address	C/ALCALA S/N POLIGONO EL CORZO, 28890 LOECHES MADRID, Spain
Contact details	info@terre-armee.com
Website	https://www.terre-armee.com

EPD STANDARDS, SCOPE AND VERIFICATION

Program operator	EPD Hub, hub@epdhub.com
Reference standard	EN 15804+A2:2019 and ISO 14025
PCR	EPD Hub Core PCR version 1.0, 1 Feb 2022
Sector	Construction product
Category of EPD	Third party verified EPD
Scope of the EPD	Cradle to gate with options, A4-A5, and modules C1-C4, D
EPD author	Anais Grandclerc
EPD verification	Independent verification of this EPD and data, according to ISO 14025: ☐ Internal verification ☑ External verification
EPD verifier	Haiha Nguyen, as an authorized verifier acting for EPD Hub Limited

The manufacturer has the sole ownership, liability, and responsibility for the EPD. EPDs within the same product category but from different programs may not be comparable. EPDs of construction products may not be comparable if they do not comply with EN 15804 and if they are not compared in a building context.

PRODUCT

Product name	TerraClass® reinforced by steel
Place of production	C/ALCALA S/N POLIGONO EL CORZO, 28890 LOECHES MADRID
Period for data	2022
Averaging in EPD	Multiple products
Variation in GWP-fossil for A1-A3	29.6 %

ENVIRONMENTAL DATA SUMMARY

Declared unit	1 m3
Declared unit mass	2220.25 kg
GWP-fossil, A1-A3 (kgCO2e)	3,38E+02
GWP-total, A1-A3 (kgCO2e)	3,36E+02
Secondary material, inputs (%)	1.49
Secondary material, outputs (%)	81.9
Total energy use, A1-A3 (kWh)	723
Total water use, A1-A3 (m3e)	2.17

PRODUCT AND MANUFACTURER

ABOUT THE MANUFACTURER

The reinforced earth plant in Loeches, Spain, is a prefabrication plant for concrete elements. Among a wide range of prefabricated elements, they offer concrete panels for facing of reinforced earth walls.

PRODUCT DESCRIPTION

TerraClass® is a concrete panel with a cruciform shape. This panel is reinforced by steel.

Concrete panels form the facing of a reinforced earth wall. The facing is often composed of concrete panels reinforced by steel and concrete panels not reinforced by steel. Behind this facing is a backfill reinforced with geosynthetic or metal reinforcement. Reinforced earth wall is part of retaining structures.

These panels have a compressive class strength between C35/45 and C45/55.

Further information can be found at https://www.terre-armee.com.

PRODUCT RAW MATERIAL MAIN COMPOSITION

Raw material category	Amount, mass- %	Material origin
Metals	1.4	Spain
Minerals	98.6	Spain
Fossil materials	0	
Bio-based materials	0	

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	0.83

FUNCTIONAL UNIT AND SERVICE LIFE

Declared unit	1 m^3
Mass per declared unit	2220.25 kg

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

SYSTEM BOUNDARY

This EPD covers the life-cycle modules listed in the following table.

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
x	x	x	x	x	MND	MND	MND	MND	MND	MND	MND	x	x	x	x	x
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.

MANUFACTURING AND PACKAGING (A1-A3)

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. This stage includes all raw materials which end up in the final products as well as the electricity and heat production which are consumed during the manufacturing at production facilities and packaging and ancillary materials.

For A1 phase, the main raw materials for pre-cast concrete are cement, aggregates additions and water. In the manufacturing, CEM I cement, and limestone are used in this formulation. Additives, such as polymers, are also used in concrete to improve its workability (superplasticizer). The pre-cast concrete also includes steel bars which act as reinforcement. The steel has been modelled using Ecoinvent data for primary steel (6%), secondary steel (94%) and a hot rolling process, which is representative of the reinforcing steel used.
Concrete does not harden by evaporation; it hardens or forms by a chemical process called hydration. The water added to concrete mix becomes a part of the concrete and never leaves concrete or evaporates.

For A3 phase, the electricity used to manufacture TerraClass panels is 30% from solar panels installed in the plant and 70% based on an average for the Spanish market.

TRANSPORT AND INSTALLATION (A4-A5)

Transportation impacts occurred from final products delivery to construction site (A4) cover fuel direct exhaust emissions, environmental impacts of fuel production, as well as related infrastructure emissions.

The type of transportation used is transport by land euro 6 lorry > 32 tons. Freight mode and distances for transportation from the production site to the construction site has been approached by an averaged transport scenario based on a barycentric method applied to sales on a representative year (an average of 643 km by lorry). Transportation does not cause losses as product are packaged properly.

Regarding the installation process (A5), we considered that 5580 hours of lifting panels over one year are necessary to install 442 992 m² of concrete panels (data from an installation company). 0.013 hours are then necessary for the lifting of 1 m² of panels equivalent to 0.14 m3 of concrete (the thicknesses of these panels measure 14 cm). As a result, 0.093 hours for 1 m3 of concrete are necessary. The crane used has a power around 50 kW.

There is no installation loss during A5 phase. Wood from the blocks used for the packaging is chipped and sold as fuel to create energy. 50 km is considered from the construction site to the waste treatment location.

PRODUCT USE AND MAINTENANCE (B1-B7)

This EPD does not cover the use phase.
Air, soil, and water impacts during the use phase have not been studied.

PRODUCT END OF LIFE (C1-C4, D)

For C1 phase, the process for demolition of concrete panels requires demolition machine and standard crushing machines to remove the concrete from the reinforced steel on-site. We consider that 1.5L of diesel are used for 1 m3 of concrete in demolition and 0,22 L are consumed to crush concrete. A total of 1.72 L is consumed and with a calorific value of 10.74 kWh/L, we can estimate a diesel consumption for C1 phase equal to 18.5 kWh.

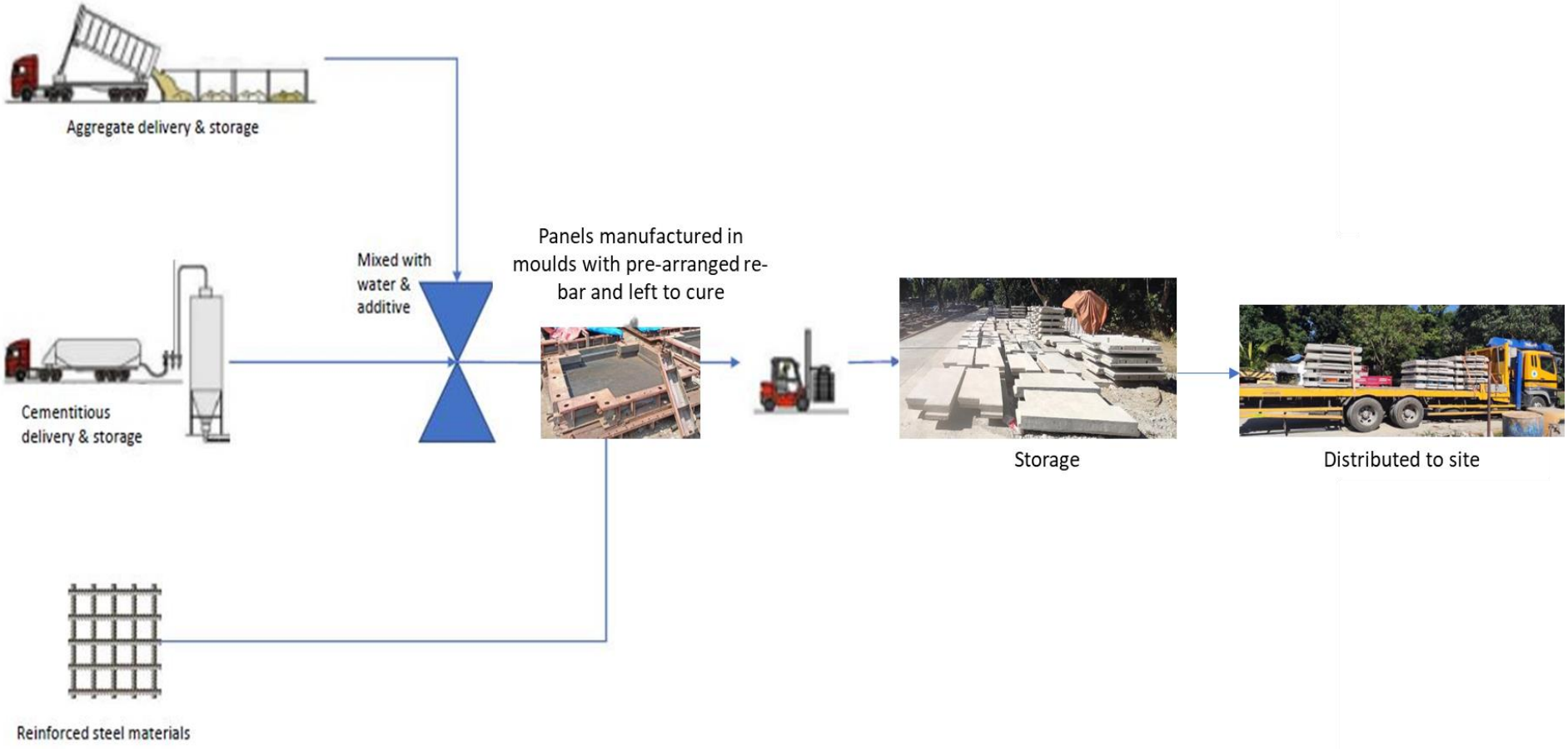
For C2 phase, it is estimated that there is no mass loss during the use of the product, therefore the end-of-life product is assumed that it has the same weight with the declared product. Transportation distance to the closest disposal area is estimated as 50 km and the transportation method is assumed as lorry which is the most common.

For C3 phase, concrete is sent directly to recycling facilities for 82% of the total amount (based on the European average from the report *Mineral waste from construction and demolition, waste treatment, 2020, European Environment Agency*) and steel is sent directly to recycling facilities for 85% of the total amount (based on *World Steel Association Report, 2020*).

For C4 phase, it is assumed that 18 % of concrete waste is sent to landfill and steel is sent directly to landfill for 15% of the total amount.

Module D claims the loads and benefits beyond the system boundaries from concrete and steel recycling, and packaging wood incineration with energy recovery.

MANUFACTURING PROCESS



LIFE-CYCLE ASSESSMENT

CUT-OFF CRITERIA

The study does not exclude any modules or processes which are stated mandatory in the reference standard 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. All allocations are done as per the reference standards and the applied PCR. In this study, allocation has been done in the following ways:

Data type	Allocation
Raw materials	No allocation
Packaging materials	No allocation
Ancillary materials	Not applicable
Manufacturing energy and waste	Allocated by mass or volume

AVERAGES AND VARIABILITY

Type of average	Multiple products
Averaging method	Representative product
Variation in GWP-fossil for A1-A3	29.6 %

7 different concrete formulas are produced in this plant and used to manufacture TerraClass panels.
The formula used for this EPD is the average between the two best-selling formulas.
The formula with the highest CO_2 emissions (i.e. the highest cement content) has an emission factor for A1-A3 equal to 438 $kgCO_2/m^3$. The formula with the lowest CO_2 emissions (i.e. the lowest cement content) has an emission factor for A1-A3 equal to 332 $kgCO_2/m^3$.
The average product used for the EPD has an emission factor for A1-A3 equal to 338 $kgCO_2/m^3$.
The difference between the average and the highest is therefore less than 50% (29.6% difference), and the difference between the average and the lowest is also less than 50% (1.8% difference).

LCA SOFTWARE AND BIBLIOGRAPHY

This EPD has been created using One Click LCA EPD Generator. The LCA and EPD have been prepared according to the reference standards and ISO 14040/14044. The EPD Generator uses Ecoinvent v3.8, Plastics Europe, Federal LCA Commons and One Click LCA databases as sources of environmental data.

ENVIRONMENTAL IMPACT DATA

CORE ENVIRONMENTAL IMPACT INDICATORS – EN 15804+A2, PEF

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
GWP – total[1)]	kg CO_2e	3,19E+02	5,57E+00	1,11E+01	3,36E+02	1,24E+02	5,03E+00	MND	MND	MND	MND	MND	MND	MND	6,11E+00	9,66E+00	8,62E+00	2,10E+00	-1,76E+01
GWP – fossil	kg CO_2e	3,19E+02	5,56E+00	1,41E+01	3,38E+02	1,24E+02	1,98E+00	MND	MND	MND	MND	MND	MND	MND	6,11E+00	9,66E+00	8,61E+00	2,10E+00	-1,76E+01
GWP – biogenic	kg CO_2e	0,00E+00	0,00E+00	-3,04E+00	-3,04E+00	0,00E+00	3,04E+00	MND	MND	MND	MND	MND	MND	MND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
GWP – LULUC	kg CO_2e	8,93E-02	2,09E-03	3,94E-03	9,53E-02	4,66E-02	2,07E-04	MND	MND	MND	MND	MND	MND	MND	6,09E-04	3,62E-03	8,58E-04	1,98E-03	-2,04E-02
Ozone depletion pot.	kg CFC_{-11}e	1,26E-05	1,39E-06	1,57E-06	1,55E-05	3,10E-05	3,64E-07	MND	MND	MND	MND	MND	MND	MND	1,31E-06	2,41E-06	1,84E-06	8,50E-07	-1,32E-06
Acidification potential	mol H^+e	8,89E-01	1,77E-02	6,83E-02	9,75E-01	3,96E-01	1,76E-02	MND	MND	MND	MND	MND	MND	MND	6,35E-02	3,08E-02	8,95E-02	1,97E-02	-1,08E-01
EP-freshwater[2)]	kg Pe	5,05E-03	3,97E-05	2,11E-04	5,30E-03	8,88E-04	7,14E-06	MND	MND	MND	MND	MND	MND	MND	2,03E-05	6,90E-05	2,85E-05	2,20E-05	-9,40E-04
EP-marine	kg Ne	2,24E-01	3,91E-03	1,45E-02	2,42E-01	8,74E-02	7,79E-03	MND	MND	MND	MND	MND	MND	MND	2,81E-02	6,79E-03	3,96E-02	6,84E-03	-2,29E-02
EP-terrestrial	mol Ne	2,63E+00	4,34E-02	1,72E-01	2,84E+00	9,69E-01	8,53E-02	MND	MND	MND	MND	MND	MND	MND	3,08E-01	7,53E-02	4,34E-01	7,52E-02	-2,94E-01
POCP ("smog")[3)]	kg NMVOCe	7,02E-01	1,71E-02	4,74E-02	7,66E-01	3,82E-01	2,35E-02	MND	MND	MND	MND	MND	MND	MND	8,48E-02	2,97E-02	1,19E-01	2,19E-02	-8,30E-02
ADP-minerals & metals[4)]	kg Sbe	1,36E-03	1,36E-05	1,54E-05	1,39E-03	3,04E-04	9,43E-07	MND	MND	MND	MND	MND	MND	MND	3,10E-06	2,36E-05	4,37E-06	4,83E-06	-1,96E-04
ADP-fossil resources	MJ	1,71E+03	8,89E+01	4,99E+01	1,85E+03	1,99E+03	2,32E+01	MND	MND	MND	MND	MND	MND	MND	8,23E+01	1,54E+02	1,16E+02	5,76E+01	-2,37E+02
Water use[5)]	m^3e depr.	6,82E+01	4,10E-01	2,39E+01	9,25E+01	9,16E+00	7,60E-02	MND	MND	MND	MND	MND	MND	MND	2,21E-01	7,12E-01	3,11E-01	1,83E-01	-2,80E+01

1) GWP = Global Warming Potential; 2) EP = Eutrophication potential. Required characterisation method and data are in kg P-eq. Multiply by 3,07 to get PO4e; 3) POCP = Photochemical ozone formation; 4) ADP = Abiotic depletion potential; 5) 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 experience with the indicator.

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

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Particulate matter	Incidence	7,46E-06	6,46E-07	4,62E-07	8,57E-06	1,44E-05	4,71E-07	MND	MND	MND	MND	MND	MND	MND	1,70E-06	1,12E-06	1,58E-05	3,98E-07	-1,42E-06
Ionizing radiation[6)]	kBq U235e	1,84E+01	4,58E-01	7,41E+00	2,63E+01	1,02E+01	1,13E-01	MND	MND	MND	MND	MND	MND	MND	3,78E-01	7,95E-01	5,33E-01	2,60E-01	-3,02E+00
Ecotoxicity (freshwater)	CTUe	3,20E+03	7,39E+01	1,92E+02	3,47E+03	1,65E+03	1,43E+01	MND	MND	MND	MND	MND	MND	MND	4,94E+01	1,28E+02	6,97E+01	3,76E+01	-3,67E+02
Human toxicity, cancer	CTUh	8,72E-07	1,92E-09	9,22E-09	8,83E-07	4,29E-08	5,97E-10	MND	MND	MND	MND	MND	MND	MND	1,90E-09	3,34E-09	2,67E-09	9,39E-10	1,00E-08
Human tox. non-cancer	CTUh	2,88E-06	7,52E-08	1,52E-07	3,10E-06	1,68E-06	1,08E-08	MND	MND	MND	MND	MND	MND	MND	3,57E-08	1,31E-07	5,04E-08	2,46E-08	-3,35E-07
SQP[7)]	-	2,52E+03	1,04E+02	9,80E+01	2,72E+03	2,31E+03	3,35E+00	MND	MND	MND	MND	MND	MND	MND	1,07E+01	1,80E+02	1,51E+01	1,23E+02	-2,10E+02

6) 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; 7) SQP = Land use related impacts/soil quality.

USE OF NATURAL RESOURCES

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Renew. PER as energy[8)]	MJ	1,23E+02	1,15E+00	3,70E+02	4,94E+02	2,57E+01	1,83E-01	MND	MND	MND	MND	MND	MND	MND	4,70E-01	2,00E+00	6,62E-01	5,00E-01	-2,09E+01
Renew. PER as material	MJ	0,00E+00	0,00E+00	8,08E+00	8,08E+00	0,00E+00	-8,08E+00	MND	MND	MND	MND	MND	MND	MND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Total use of renew. PER	MJ	1,23E+02	1,15E+00	3,78E+02	5,02E+02	2,57E+01	-7,90E+00	MND	MND	MND	MND	MND	MND	MND	4,70E-01	2,00E+00	6,62E-01	5,00E-01	-2,09E+01
Non-re. PER as energy	MJ	1,68E+03	8,89E+01	3,46E+02	2,11E+03	1,99E+03	2,32E+01	MND	MND	MND	MND	MND	MND	MND	8,23E+01	1,54E+02	1,16E+02	5,76E+01	-2,37E+02
Non-re. PER as material	MJ	3,14E+01	0,00E+00	1,53E+01	4,67E+01	0,00E+00	-1,53E+01	MND	MND	MND	MND	MND	MND	MND	0,00E+00	0,00E+00	-2,58E+01	-5,66E+00	0,00E+00
Total use of non-re. PER	MJ	1,71E+03	8,89E+01	3,61E+02	2,16E+03	1,99E+03	7,90E+00	MND	MND	MND	MND	MND	MND	MND	8,23E+01	1,54E+02	9,01E+01	5,19E+01	-2,37E+02
Secondary materials	kg	3,30E+01	2,50E-02	3,31E-02	3,31E+01	5,59E-01	9,07E-03	MND	MND	MND	MND	MND	MND	MND	3,22E-02	4,35E-02	4,54E-02	1,21E-02	1,45E+00
Renew. secondary fuels	MJ	7,63E-03	2,21E-04	1,30E-02	2,08E-02	4,93E-03	3,05E-05	MND	MND	MND	MND	MND	MND	MND	1,05E-04	3,83E-04	1,48E-04	3,16E-04	-1,91E-03
Non-ren. secondary fuels	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	MND	MND	MND	MND	MND	MND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Use of net fresh water	m^3	1,94E+00	1,18E-02	2,17E-01	2,17E+00	2,63E-01	1,71E-03	MND	MND	MND	MND	MND	MND	MND	5,00E-03	2,05E-02	7,04E-03	6,30E-02	-6,89E-01

8) PER = Primary energy resources.

END OF LIFE – WASTE

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Hazardous waste	kg	2,02E+01	9,53E-02	5,10E-01	2,08E+01	2,13E+00	3,33E-02	MND	MND	MND	MND	MND	MND	MND	1,10E-01	1,65E-01	1,55E-01	0,00E+00	-2,19E+00
Non-hazardous waste	kg	2,21E+02	1,66E+00	1,10E+01	2,33E+02	3,70E+01	5,28E-01	MND	MND	MND	MND	MND	MND	MND	7,74E-01	2,88E+00	1,09E+00	3,99E+02	-3,91E+01
Radioactive waste	kg	8,37E-03	6,13E-04	3,01E-03	1,20E-02	1,37E-02	1,63E-04	MND	MND	MND	MND	MND	MND	MND	5,79E-04	1,06E-03	8,16E-04	0,00E+00	-1,06E-03

END OF LIFE – OUTPUT FLOWS

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Components for re-use	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	MND	MND	MND	MND	MND	MND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Materials for recycling	kg	0,00E+00	0,00E+00	2,53E+02	2,53E+02	0,00E+00	0,00E+00	MND	MND	MND	MND	MND	MND	MND	0,00E+00	0,00E+00	1,82E+03	0,00E+00	0,00E+00
Materials for energy rec	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,68E+00	MND	MND	MND	MND	MND	MND	MND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Exported energy	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	MND	MND	MND	MND	MND	MND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00

ENVIRONMENTAL IMPACTS – EN 15804+A1, CML / ISO 21930

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Global Warming Pot.	kg CO_2e	3,16E+02	5,51E+00	1,41E+01	3,36E+02	1,23E+02	1,95E+00	MND	MND	MND	MND	MND	MND	MND	6,05E+00	9,57E+00	8,52E+00	2,06E+00	-1,71E+01
Ozone depletion Pot.	kg CFC_{-11}e	1,03E-05	1,10E-06	1,25E-06	1,27E-05	2,46E-05	2,88E-07	MND	MND	MND	MND	MND	MND	MND	1,03E-06	1,91E-06	1,46E-06	6,72E-07	-1,13E-06
Acidification	kg SO_2e	6,96E-01	1,44E-02	5,31E-02	7,63E-01	3,21E-01	1,26E-02	MND	MND	MND	MND	MND	MND	MND	4,53E-02	2,50E-02	6,38E-02	1,49E-02	-8,43E-02
Eutrophication	kg PO_4^3e	2,50E-01	3,05E-03	1,25E-02	2,65E-01	6,81E-02	6,22E-03	MND	MND	MND	MND	MND	MND	MND	1,05E-02	5,29E-03	1,48E-02	3,22E-03	-3,89E-02
POCP (“smog”)	kg C_2H_4e	2,98E-02	6,70E-04	2,87E-03	3,33E-02	1,50E-02	2,94E-04	MND	MND	MND	MND	MND	MND	MND	9,91E-04	1,16E-03	1,40E-03	6,25E-04	-6,66E-03
ADP-elements	kg Sbe	7,93E-04	1,32E-05	1,91E-04	9,97E-04	2,96E-04	9,27E-07	MND	MND	MND	MND	MND	MND	MND	3,05E-06	2,30E-05	4,30E-06	4,76E-06	-1,94E-04
ADP-fossil	MJ	1,71E+03	8,89E+01	3,61E+02	2,16E+03	1,99E+03	2,32E+01	MND	MND	MND	MND	MND	MND	MND	8,23E+01	1,54E+02	1,16E+02	5,76E+01	-2,37E+02

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 reference standard, 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 digital background data for this EPD

Why does verification transparency matter? Read more online
This EPD has been generated by One Click LCA EPD generator, which has been verified and approved by the EPD Hub.

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 reference standard.

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.

HaiHa Nguyen, as an authorized verifier acting for EPD Hub Limited
03.04.2024

VERIFIED ISO 14025