ENVIRONMENTAL PRODUCT DECLARATION

IN ACCORDANCE WITH EN 15804+A2 & ISO 14025

MasterRoc SA 168

Master Builders Solutions

EPD HUB, HUB-2185

Publishing date 29.10.2024, last updated date 29.10.2024, valid until 29.10.2029

GENERAL INFORMATION

MANUFACTURER

Manufacturer	Master Builders Solutions
Address	Gullfotdalen 4, NO-2120 Sagstua, Norway
Contact details	sustainability-team@masterbuilders.com
Website	www.master-builders-solutions.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 1.1, 1 Dec 2023
Sector	Construction product
Category of EPD	Third party verified EPD
Scope of the EPD	Cradle to gate with options, A5, and modules C1-C4 and D
EPD author	Natalia Kupferschmidt - Master Builders Solutions
EPD verification	Independent verification of this EPD and data, according to ISO 14025: ☐ Internal certification ☑ 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	MasterRoc SA 168
Place of production	Sagstua, Norway
Period for data	2023
Averaging in EPD	No averaging

ENVIRONMENTAL DATA SUMMARY

Declared unit	1 kg
Declared unit mass	1 kg
GWP-fossil, A1-A3 ($kgCO_2e$)	0.54
GWP-total, A1-A3 ($kgCO_2e$)	0.54
Secondary material, inputs (%)	0.3
Secondary material, outputs (%)	22
Total energy use, A1-A3 (kWh)	2.5
Total water use, A1-A3 (m^3e)	0.02

PRODUCT AND MANUFACTURER

ABOUT THE MANUFACTURER

Master Builders Solutions is one of the leading suppliers of concrete admixtures and underground construction solutions worldwide. With over a century of experience in the construction industry, we leverage cutting-edge technologies, a global community of experts at the core of our business, as well as in-depth knowledge of local building needs to provide innovative and sustainable solutions.

PRODUCT DESCRIPTION

MasterRoc SA 168 is an alkali-free, liquid highly efficient accelerator for shotcrete based on calcium nitrate. The product dosage can be adjusted to the desired setting and curing time. The unique formulation provides rapid setting, continuous increase of early strength, good durability and final strength.

The areas of use for the product include temporary and permanent rock protection for tunnelling and mining works and stabilization of inclined surfaces. The product is also suitable for accelerating cement-based applications such as applications for annular gaps in TBM tunnels, cement injection of soil and foamed concrete.

MasterRoc SA 168 is particularly suitable for wet-sprayed concrete for rock protection:

- The fast-setting property enables a quick work process and that thick layers of shotcrete can be applied layer upon layer during one working step.
- The unique product formulation provides rapid bonding, continuous development of resistance to early aging, high durability and good long-term strength.
- Very low dust formation during use and therefore a good working environment.
- Enables applications with less recoil when the correct angle of the nozzle and the correct distance are used.

Further information can be found at www.master-builders-solutions.com

PRODUCT RAW MATERIAL MAIN COMPOSITION

Raw material category	Amount, mass- %	Material origin
Metals	-	-
Minerals	> 97	Norway, Finland, Spain, Germany
Fossil materials	< 3	Germany
Bio-based materials	-	-

BIOGENIC CARBON CONTENT

Product's biogenic carbon content at the factory gate.

Biogenic carbon content in product, kg C	0.005
Biogenic carbon content in packaging, kg C	0

FUNCTIONAL UNIT

Declared unit	1 kg
Mass per declared unit	1 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	MND	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 considered for the product stage cover the manufacturing of raw materials used in the production as well as packaging materials and other ancillary materials. Also, fuels used by machines, and handling of waste formed in the production processes at the manufacturing facilities are included in this stage. The study also considers the material losses occurring during the manufacturing processes as well as losses during electricity transmission.

Concrete admixtures are manufactured by mixing the ingredients together in batch mode, which are further poured into containers or pumped into the truck tankers. Most of the product is shipped with tanker trucks to customers. According to the 2023 company data, 6% is shipped using intermediate bulk containers (IBC). The IBC consists of 20 kg steel cages, 21 kg HDPE integrated pallet and 15 kg HDPE "bottle" (the holding volume). IBC contains a total of 1140 kg of MasterRoc SA 168 product. It was assumed that the IBC is reused 3 times.

TRANSPORT AND INSTALLATION (A4-A5)

Transportation impacts occurred from final product delivery to the construction site (A4) is not modelled.

During concrete manufacture, concrete admixtures are usually added along with the mixing water or included in premixed concrete. The material loss during installation is therefore 0% for admixtures. Since 6% of the product is shipped in IBC packaging, the treatment of the packaging waste is as well modelled in A5.

PRODUCT USE AND MAINTENANCE (B1-B7)

This EPD does not cover the use phase.

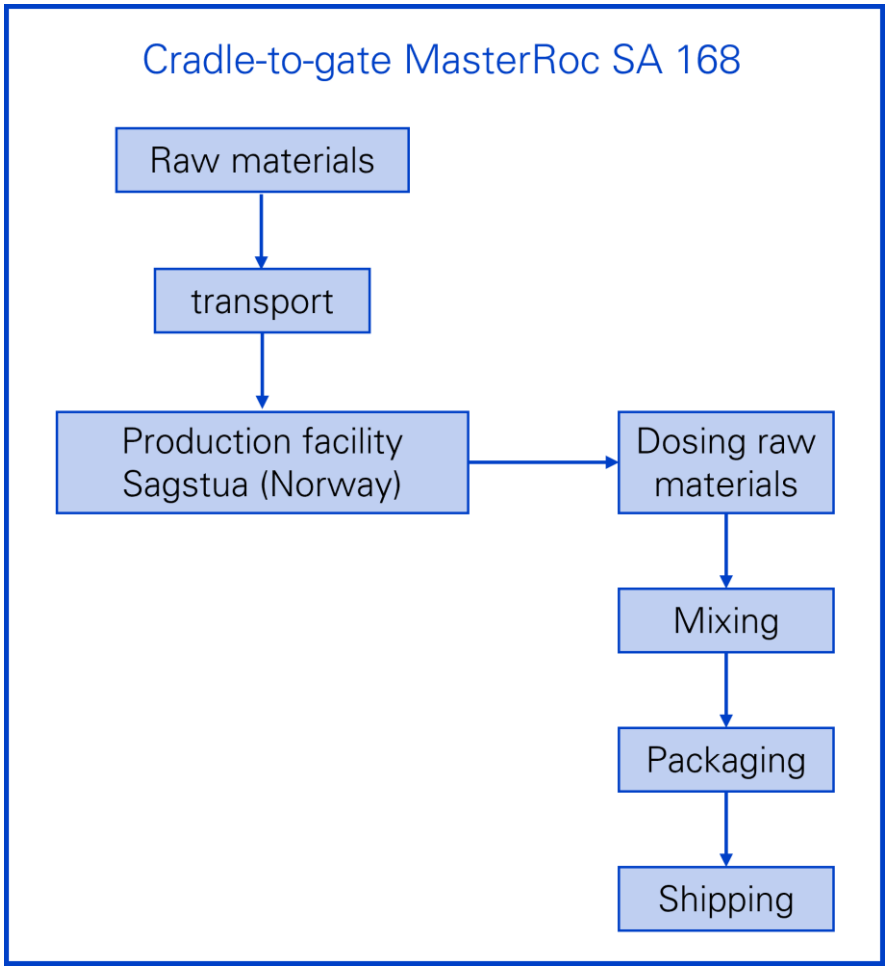
Air, soil, and water impacts during the use phase have not been studied.

PRODUCT END OF LIFE (C1-C4, D)

The admixture becomes an inseparable part of the concrete, and therefore it undergoes a similar end of life scenario. The deconstruction of concrete takes place in C1 module which considers energy for dismantling, particulate matter emissions from dismantling and handling. After the demolition, the debris are transported to the end-of-life processing (C2) where all the impacts related to the transport processes are considered. According to the regional data, 44% of the waste concrete is treated to be reused as recycled aggregates (C3) in Norway and the rest (56%) is treated as inert material for landfill (C4).

The benefits and loads of recycled aggregates (from C3) as well as benefits and loads of the packaging (IBC) waste (from A5) are modelled and included beyond the system boundary (D).

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	Allocated by mass or volume
Ancillary materials	Not applicable
Manufacturing energy and waste	Allocated by mass or volume

The following assumptions were made:

- Transport distance for packaging waste (A5) and concrete waste at the end-of-life (C2) is considered 100 km as the worst-case scenario.
- Consumed energy for demolition (C1) is 0.07 MJ / kg [Source: EUR 29123 EN Model for Life Cycle Assessment (LCA) of buildings].
- End of Life waste processing ration for Norway is considered 44% as recycling concrete [Source: Reuse, recycling and recovery of construction and demolition waste in the Nordic countries (norden.org)] and reminding 56% as landfill (C3 and C4).
- The steel cage of the IBC is produced from 42.4% steel scrap and 57.6% from virgin material [Source: World Steel in Figures from World Steel Association].
- Waste processing ratios for HDPE part of the IBC are 34.6% for recycling and reuse as plastic, 42.0% for incineration with 73% efficiency, and 23.4% sanitary landfill (A5) [Sources: Energy Recovery from Waste Incineration—The Importance of Technology Data and System Boundaries on CO2 Emissions by Eriksson O., Finnveden G. (2017)]
- Waste processing ratios for steel cage of the IBC are 85% recycling and reuse and 15% landfill [Source: The Global Life Cycle of Stainless Steel].

AVERAGES AND VARIABILITY

Type of average	No averaging
Averaging method	Not applicable
Variation in GWP-fossil for A1-A3	-

This EPD is product and factory specific and does not contain average calculations.

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. Ecoinvent 3.8 and One Click LCA databases were used 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	4,81E-01	5,46E-02	3,19E-03	5,39E-01	MND	8,92E-04	MND	MND	MND	MND	MND	MND	MND	6,44E-03	9,39E-03	1,13E-03	2,14E-03	-4,67E-03
GWP – fossil	kg CO_2e	4,79E-01	5,46E-02	3,18E-03	5,37E-01	MND	8,85E-04	MND	MND	MND	MND	MND	MND	MND	6,44E-03	9,38E-03	1,77E-03	2,95E-03	-4,66E-03
GWP – biogenic	kg CO_2e	1,45E-03	0,00E+00	3,82E-07	1,45E-03	MND	7,31E-06	MND	MND	MND	MND	MND	MND	MND	0,00E+00	0,00E+00	-6,36E-04	-8,09E-04	-3,70E-06
GWP – LULUC	kg CO_2e	9,34E-04	2,01E-05	4,42E-06	9,58E-04	MND	4,19E-08	MND	MND	MND	MND	MND	MND	MND	6,41E-07	3,46E-06	1,76E-07	2,78E-06	-4,86E-06
Ozone depletion pot.	kg CFC_{-11}e	3,96E-08	1,26E-08	1,04E-10	5,22E-08	MND	6,82E-12	MND	MND	MND	MND	MND	MND	MND	1,38E-09	2,16E-09	3,78E-10	1,19E-09	-3,32E-10
Acidification potential	mol H^+e	6,93E-03	2,31E-04	1,39E-05	7,18E-03	MND	3,38E-07	MND	MND	MND	MND	MND	MND	MND	6,69E-05	3,97E-05	1,84E-05	2,77E-05	-2,55E-05
EP-freshwater[2)]	kg Pe	2,77E-05	4,47E-07	1,20E-07	2,83E-05	MND	1,09E-09	MND	MND	MND	MND	MND	MND	MND	2,13E-08	7,68E-08	5,86E-09	3,09E-08	-2,18E-07
EP-marine	kg Ne	6,46E-04	6,87E-05	2,67E-06	7,17E-04	MND	1,16E-07	MND	MND	MND	MND	MND	MND	MND	2,96E-05	1,18E-05	8,13E-06	9,60E-06	-5,55E-06
EP-terrestrial	mol Ne	5,82E-03	7,58E-04	2,86E-05	6,60E-03	MND	1,22E-06	MND	MND	MND	MND	MND	MND	MND	3,25E-04	1,30E-04	8,92E-05	1,06E-04	-7,13E-05
POCP ("smog")[3)]	kg NMVOCe	1,87E-03	2,42E-04	1,17E-05	2,12E-03	MND	3,40E-07	MND	MND	MND	MND	MND	MND	MND	8,93E-05	4,17E-05	2,45E-05	3,07E-05	-2,02E-05
ADP-minerals & metals[4)]	kg Sbe	2,10E-05	1,28E-07	2,61E-08	2,11E-05	MND	1,17E-09	MND	MND	MND	MND	MND	MND	MND	3,26E-09	2,20E-08	8,98E-10	6,78E-09	-3,69E-08
ADP-fossil resources	MJ	8,07E+00	8,19E-01	6,87E-02	8,96E+00	MND	5,79E-04	MND	MND	MND	MND	MND	MND	MND	8,66E-02	1,41E-01	2,38E-02	8,08E-02	-7,52E-02
Water use[5)]	m^3e depr.	6,12E-01	3,67E-03	1,73E-02	6,33E-01	MND	3,10E-05	MND	MND	MND	MND	MND	MND	MND	2,33E-04	6,31E-04	6,39E-05	2,57E-04	-7,03E-03

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

ADDITIONAL 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	5,25E-08	6,29E-09	1,54E-10	5,90E-08	MND	5,52E-12	MND	MND	MND	MND	MND	MND	MND	1,79E-09	1,08E-09	3,76E-09	5,58E-10	-3,28E-10
Ionizing radiation[6)]	kBq U235e	9,45E-02	3,90E-03	4,71E-04	9,88E-02	MND	3,77E-06	MND	MND	MND	MND	MND	MND	MND	3,98E-04	6,71E-04	1,09E-04	3,66E-04	-7,40E-04
Ecotoxicity (freshwater)	CTUe	1,92E+01	7,37E-01	5,94E-02	2,00E+01	MND	1,20E-03	MND	MND	MND	MND	MND	MND	MND	5,20E-02	1,27E-01	1,43E-02	5,28E-02	-7,64E-02
Human toxicity, cancer	CTUh	1,46E-09	1,81E-11	8,25E-12	1,49E-09	MND	9,74E-14	MND	MND	MND	MND	MND	MND	MND	1,99E-12	3,11E-12	5,48E-13	1,32E-12	1,23E-12
Human tox. non-cancer	CTUh	2,76E-08	7,30E-10	4,04E-11	2,84E-08	MND	2,29E-12	MND	MND	MND	MND	MND	MND	MND	3,76E-11	1,25E-10	1,03E-11	3,45E-11	-7,50E-11
SQP[7)]	-	5,74E+00	9,44E-01	1,64E-02	6,70E+00	MND	8,18E-04	MND	MND	MND	MND	MND	MND	MND	1,13E-02	1,62E-01	3,09E-03	1,73E-01	-4,97E-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	7,67E-01	9,23E-03	5,25E-02	8,29E-01	MND	3,41E-05	MND	MND	MND	MND	MND	MND	MND	4,95E-04	1,59E-03	1,36E-04	7,02E-04	-4,55E-03
Renew. PER as material	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	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
Total use of renew. PER	MJ	7,67E-01	9,23E-03	5,25E-02	8,29E-01	MND	3,41E-05	MND	MND	MND	MND	MND	MND	MND	4,95E-04	1,59E-03	1,36E-04	7,02E-04	-4,55E-03
Non-re. PER as energy	MJ	7,35E+00	8,20E-01	4,18E-02	8,21E+00	MND	5,80E-04	MND	MND	MND	MND	MND	MND	MND	8,66E-02	1,41E-01	2,38E-02	8,09E-02	-6,59E-02
Non-re. PER as material	MJ	7,13E-01	0,00E+00	2,68E-02	7,40E-01	MND	-2,68E-02	MND	MND	MND	MND	MND	MND	MND	0,00E+00	0,00E+00	-3,14E-01	-3,99E-01	0,00E+00
Total use of non-re. PER	MJ	8,06E+00	8,20E-01	6,87E-02	8,95E+00	MND	-2,62E-02	MND	MND	MND	MND	MND	MND	MND	8,66E-02	1,41E-01	-2,90E-01	-3,19E-01	-6,59E-02
Secondary materials	kg	3,03E-03	2,28E-04	2,29E-04	3,49E-03	MND	1,03E-06	MND	MND	MND	MND	MND	MND	MND	3,39E-05	3,91E-05	9,31E-06	1,70E-05	4,42E-04
Renew. secondary fuels	MJ	3,06E-05	2,30E-06	3,97E-05	7,26E-05	MND	1,29E-08	MND	MND	MND	MND	MND	MND	MND	1,11E-07	3,95E-07	3,04E-08	4,44E-07	-3,90E-07
Non-ren. secondary fuels	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	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	1,55E-02	1,06E-04	4,08E-04	1,60E-02	MND	3,24E-07	MND	MND	MND	MND	MND	MND	MND	5,26E-06	1,83E-05	1,44E-06	8,85E-05	-1,68E-04

[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	1,76E-01	1,09E-03	4,20E-04	1,78E-01	MND	3,31E-06	MND	MND	MND	MND	MND	MND	MND	1,16E-04	1,87E-04	3,18E-05	0,00E+00	-2,88E-04
Non-hazardous waste	kg	1,16E+00	1,79E-02	4,94E-03	1,18E+00	MND	5,25E-04	MND	MND	MND	MND	MND	MND	MND	8,14E-04	3,07E-03	2,24E-04	5,60E-01	-9,39E-03
Radioactive waste	kg	3,02E-05	5,48E-06	1,32E-07	3,58E-05	MND	2,78E-09	MND	MND	MND	MND	MND	MND	MND	6,10E-07	9,43E-07	1,67E-07	0,00E+00	-2,53E-07

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	MND	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	0,00E+00	0,00E+00	MND	5,17E-04	MND	MND	MND	MND	MND	MND	MND	0,00E+00	0,00E+00	4,40E-01	0,00E+00	0,00E+00
Materials for energy rec	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	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
Exported energy	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	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 – GWP-GHG - THE INTERNATIONAL EPD SYSTEM

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
GWP-GHG[9)]	kg CO_2e	4,79E-01	5,46E-02	3,18E-03	5,37E-01	MND	8,85E-04	MND	MND	MND	MND	MND	MND	MND	6,44E-03	9,38E-03	1,77E-03	2,95E-03	-4,66E-03

[9)] 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). In addition. the characterisation factors for the flows - CH4 fossil. CH4 biogenic and Dinitrogen monoxide - were updated in line with the guidance of IES PCR 1.2.5 Annex 1. This indicator is identical to the GWP-total of EN 15804:2012+A2:2019 except that the characterization factor for biogenic CO_2 is set to zero.

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

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
29.10.2024

VERIFIED ISO 14025