Environmental Product Declaration

In accordance with ISO 14025:2006 and EN 15804:2012+A2:2019/AC:2021 for:

Round Bar

from

SeAH Besteel

Programme:	The International EPD® System, www.environdec.com
Programme operator:	EPD International AB
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An EPD should provide current information and may be updated if conditions change. The stated validity is therefore subject to the continued registration and publication at www.environdec.com

General information

Programme information

Programme:	The International EPD® System
Address:	EPD International AB Box 210 60 SE-100 31 Stockholm Sweden
Website:	www.environdec.com
E-mail:	info@environdec.com

Accountabilities for PCR, LCA and independent, third-party verification
Product Category Rules (PCR)
CEN standard EN 15804 serves as the Core Product Category Rules (PCR)
Product Category Rules (PCR): Construction products 2019:14, version 1.3.1 and UN CPC code 4124, UN CPC code 4126
PCR review was conducted by: The Technical Committee of the International EPD® System. A full list of members available on www.environdec.com. The review panel may be contacted via info@environdec.com. Review chair - No chair appointed.
Life Cycle Assessment (LCA)
LCA accountability: JiSuk Baek Research Engineer, SeAH Besteel
Third-party verification
Independent third-party verification of the declaration and data, according to ISO 14025:2006, via: ☒ EPD verification by individual verifier Third-party verifier: Kripanshi Gupta, Intertek Assuris Approved by: The International EPD® System
Procedure for follow-up of data during EPD validity involves third party verifier: ☐ Yes ☒ No

The EPD owner has the sole ownership, liability, and responsibility for the EPD.

EPDs within the same product category but registered in different EPD programmes, or not compliant with EN 15804, may not be comparable. For two EPDs to be comparable, they must be based on the same PCR (including the same version number) or be based on fully-aligned PCRs or versions of PCRs; cover products with identical functions, technical performances and use (e.g. identical declared/functional units); have equivalent system boundaries and descriptions of data; apply equivalent data quality requirements, methods of data collection, and allocation methods; apply identical cut-off rules and impact assessment methods (including the same version of characterisation factors); have equivalent content declarations; and be valid at the time of comparison. For further information about comparability, see EN 15804 and ISO 14025.

Company information

Owner of the EPD: SeAH Besteel

Contact:

- Phone: +82 063 460 8516
- Address: 573-711, 522, Oehang-ro, Gunsan-si, Jeollabuk-do, Korea
- Contact: JiSuk Baek (Research Engineer), audition1234@seah.co.kr

Description of the organisation:

SeAH Besteel's journey starts with a mission. Founded in 1955, SeAH Besteel was one of the first companies to pave the way for Korea's industrial development. Today, we are South Korea's leading and most respected special steel producer. To our customers and partners, we invite you to follow SeAH Besteel's next move in our journey as we continue to forge our name in Korea and around the world.

With passion to supply the highest quality products that are cost competitive, SeAH Besteel has lead the special steel industry in Korea and have become a professional special steel company, contributing significant industrial development with its yearly production capacity of more than 2.1 million tons of steel and 1.8 million tons of steel products. SeAH Besteel is preparing to take a leap forward amid this rapidly changing business environment through innovation and overcome the underlying threats. Aggressively pursuing domestic and global markets such as the U.S, and Thailand for global expansion, SeAH Besteel is also seeking for ways to expand our business beyond just sales.

In 2022, SeAH Besteel announced our commitment to ESG management. We have set up the ESG Committee under the board and have engaged in various ESG activities based on the "GREEN Innovation" strategies. We have adopte an environmental management system (ISO 14001) to identify and manage issues affecting the environment, and monitor issues with a high risk of accidents to recognize risks and minimize damage. SeAH Besteel holds a monthly Integrated Council for Environmental Safety under the chairmanship of the CEO to regularly share plans and results of major environmental management activities. We also conduct environmental audits in each process of business investment to strengthen company-wide environmental risk management. At the investment review stage, we request relevant departments to conduct a preliminary safety and environmental review, and conduct an ad-hoc environmental impact assessment when executing the investment and a regular environmental impact assessment when the investment is completed.

SeAH Besteel is a leading supplier of the highest quality steel products that are engineered for operational reliability in various industries, including automotive, industrial machinery and energy. The objective of SeAH Besteel's on-going product and process innovation initiative is to strengthen our competitiveness in the high-purity steel market.

[Overview]

Name : SeAH Besteel Co., Ltd. Establishment February 4,1955

CEO : President Kim Chul-hee, President Shin Sang-ho

Website : https://www.seahbesteel.co.kr/about/sustainability/esg.asp

Head office : 45 Yanghwa-ro (SeAH Tower), Mapo-gu, Seoul 04036, Korea

Business : Manufacturing and sale of hot - rolled and forged steel bars

Products : Special steel, heavy forging products, die forging products and nueclear fuel casks

Product-related or management system-related certifications:

IATF 16949, ISO 9001, ISO 14001, ISO 50001, ISO 45001

Quality Management System	Quality Management System	Environment Management System	Energy Management System	Health and Safety Management System
IATF 16949	ISO 9001	ISO 14001	ISO 50001	ISO 45001

Name and location of production site(s):

Gunsan plant , 573-711, 522, Oehang-ro, Gunsan-si, Jeollabuk-do, Korea

Changnyeong plant, 635-940 100, Daehapsaneopdanji-ro, Daehap-myeon, Changnyeong-gun, Gyeongsangnam-do, Korea

Product information

Product name: Round Bar

Product identification:

Round bars are made of half-finished steel products such as bloom, billet and ingot to meet customer's specifications. The steel grades are non-alloy steel and alloy steel, especially, the high-quality special steel.

A detailed description of the product can be found on this site.
http://eng.seahbesteel.co.kr/eng/pr/brochure.jsp

- Application :

SeAH is a leading supplier of the highest quality steel products that are engineered for operational reliability in various industries, including automotive, construction, heavy equipment, industrial machinery and energy.

1) Automotive : Engine, Transmission, Chassis etc.
2) Construction & Heavy equipment : Undercarriage,Chassis, Breaker, Construction materials etc.
3) Industrial Machines : General machinery, Injection molding machines etc.
4) Construction materials : Tunnel support bar, Dowel bar, Bolt etc.

Characteristics:

The characteristics of the product are described in Table 1, 2 and 3. Table 1 shows chemical composition and application. Table 2 shows the size. Table 3 shows packing materials.

Table 1 Chemical composition and Application

Designation		Non alloy steel	Alloy steel
Chemical composition (wt.%)	Fe	96 ~ 98	92 ~ 94
	C, Si, Mn, Cr etc.	2 ~ 4	6 ~ 8
Application		Automobile, Construction, Heavy equipment, Bearing, Industrial machines	Automobile, Construction, Heavy equipment, Shipbuilding, Bearing, Industrial machines, Petro- chemistry, Spring

Table 2 Size based on the surface condition

Surface condition		Diameter	Length
Black surface	Rolling	Φ16mm ~ Φ350mm	4,500mm ~ 7,500mm
	Forging	Φ150mm ~ Φ6,800mm	Max. 21,000mm
2nd surface	Peeling	Φ20mm ~ Φ120mm	4,000mm ~ 6,800mm
	Cold drawing	Φ20mm ~ Φ50.8mm	4,500mm ~ 6,900mm

Packing:

Table 3 Packing materials

Surface condition		Packing
Black surface	Rolling	Steel wire & steel strip
	Forging	-
2nd surface	Peeling	Polypropylene packing, Steel strip
	Cold drawing	Steel strip

Manufacturing Process:

Process diagram is shown in Figure 1. A detailed description of the processes is shown in the Table 4.

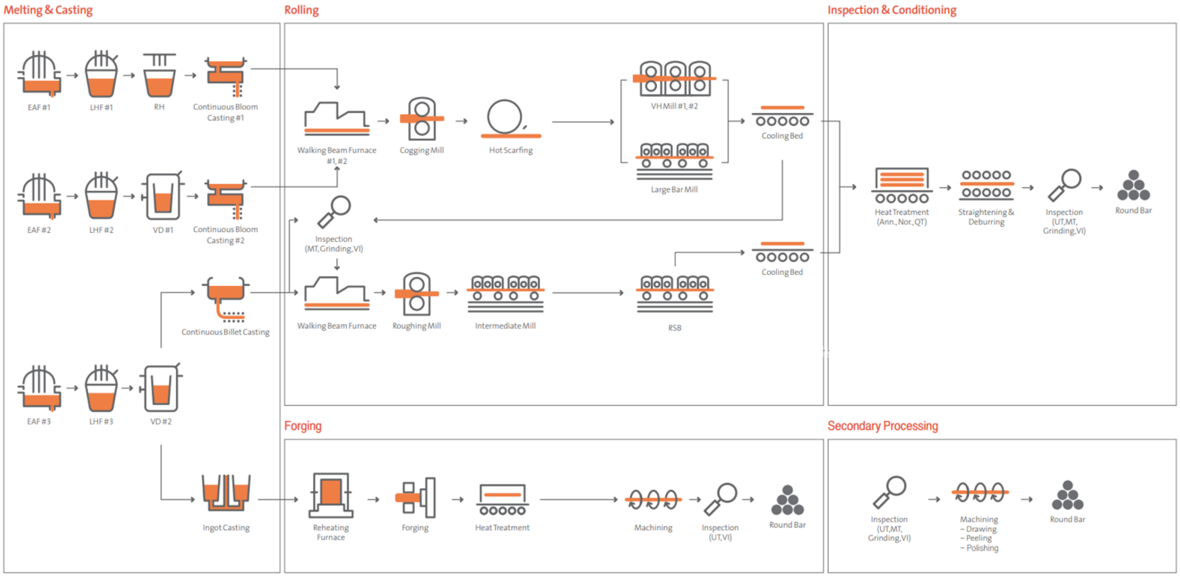

Figure 1 Manufacturing Process

Table 4 Manufacturing process of Round Bar

Process		Description
Melting & Casting	Electric Arc Furnace (EAF)	Process of melting solid iron scrap into liquid metallic strain using electrical and chemical energy
	Ladle Heating Furnace (LHF)	Metallic stain produced in the electric furnace received in a vessel called ladle - Rise in temperature using electric energy - Adjust chemical elements through alloy metal insertion - Process that reduces refinement through making optimum slag
	Vacuum Degassing (VD)	Process of degassing hydrogen, nitrogen, oxygen and etc. in metallic stain by exposing finished clean metallic stain to low vacuum state under 0.8m bar lower than atmospheric pressure - VD: Equipment that exposes ladle with metallic stain into a vacuum state by putting it in equipment in a tank form - Ruhrstahl Heraeus (RH): Equipment that exposes metallic stain in ladle to a vacuum state by reverting it into a particular vessel
	Continuous Casting (CC)	Process of producing bloom/billet by infusing melted steel in a certain form of mold - Clean steel and high alloy steel production through M-EMS/F-EMS and dynamic soft reduction equipment
Rolling process		Process of making a half-finished product, bloom, that meets customer's demand, through a roller Especially large size rolling material production up to Φ350 available by a cutting-edge VH Mill
Inspection & Conditioning		All products are inspected under strict standards before being delivered to customers. Through leakage magnetic flux testing, magnetic particle testin g, and ultrasonic testing, we check for defects inside and outside the produ ct and supply products of verified quality.
Forging		Process of making a solid metal material into a constant shape by a mechanical method of tapping or pressing with a hammer, etc.
Secondary Processing		Various heat treatments such as QT and annealing as well as peeling / cold-drawing processes high value-added secondary processing materials.

UN CPC code:

4124 – Bars and rods, hot-rolled, of iron or steel

4126 – Bars, rods, angles, shapes and sections, cold processed or further worked, of iron or steel; angles, shapes and sections, hot-rolled, hot-drawn or extruded, of alloy steel; steel wire

Geographical scope: Global

Manufacturing site: Gunsan plant and Changneyong plant. A weighted average was calculated to sum the environmental impacts considering the production volume of both sites.

LCA information

Declared unit: 1 tonne of Round Bar

Time representativeness: Fiscal year 2022, 12 months from January to December

Database(s) and LCA software used: Gabi 10 software system. Gabi database provides the life cycle inventory data for several of the raw and process materials obtained from upstream system. The database used are professional database, Full US extension database XVII and Ecoinvent 3.8.

Electricity Mix: The dataset for Korean national grid mix in this EPD study has climate change impact - total, 0.69kg CO_2/kWh. The reference year of the dataset is 2019.

Description of system boundaries: "Cradle to gate with options, module C1-C4 and module D" (A1–A3 + C + D) is selected for the LCA study according to EN 15804 Section 5.2. The detailed information for manufacturing process from Module A3 is described in the product information above.

Infrastructure/capital goods: There are no infrastructure and capital goods considered by the LCA study.

System diagram:

Figure 2 is a system diagram and Table 5 explains relevant life cycle stages and the definition of each module. The infrastructure and capital goods are excluded in the system boundary. The definition for each module in Table 5 follows Section 6.3.5 in EN158040+A2.

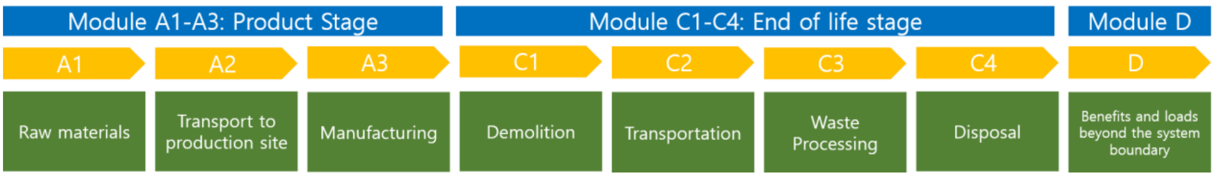

Figure 2 System diagram

Table 5 System boundary and Life Cycle

EPD Module	Life Cycle Stages	Definition
A1	Raw Material Supply	- Extraction and processing of raw materials (e.g. mining processes) and biomass production and processing (e.g. agricultural or forestry operations) - Reuse of products or materials from a previous product system - Processing of secondary materials used as input for manufacturing the product, but not including those processes that are part of the waste processing in the previous product system - Generation of electricity, steam and heat from primary energy resources, also including their extraction, refining and transport - Energy recovery and other recovery processes from secondary fuels, but not including those processes that are part of waste processing in the previous product system
A2	Transport to manufacturer	Transportation up to the factory gate and internal transport
A3	Manufacturing	- Production of ancillary materials or pre-products - Manufacturing of products and co-products - Manufacturing of Packaging
C1	De-construction demolition	deconstruction, including dismantling or demolition, of the product from the building, including initial on-site sorting of the materials
C2	Transport	transportation of the discarded product as part of the waste processing, e.g. to a recycling site and transportation of waste e.g. to final disposal.
C3	Waste processing	waste processing e.g. collection of waste fractions from the deconstruction and waste processing of material flows intended for reuse, recycling and energy recovery. Waste processing shall be modelled and the elementary flows shall be included in the inventory. Materials for energy recovery are identified based on the efficiency of energy recovery with a rate higher than 60 % without prejudice to existing legislation. Materials from which energy is recovered with an efficiency rate below 60% are not considered materials for energy recovery.
C4	Disposal	waste disposal including physical pre-treatment and management of the disposal site.
D	Reuse-Recovery-Recycling-potential	the environmental benefits or loads resulting from reusable products, recyclable materials and/or useful energy carriers leaving a product system e.g. as secondary materials or fuels.

Table 6 describes the modules declared, geographical scope, share of specific data.

Table 6 System boundary and Life Cycle

	Product stage			**Construction process stage**		**Use stage**							**End of life stage**				**Resource recovery stage**
	Raw material supply	Transport	Manufacturing	Transport	Construction installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
Module	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Modules declared	X	X	X	ND	ND	ND	ND	ND	ND	ND	ND	ND	X	X	X	X	X
Geography	KR	KR	KR	-	-	-	-	-	-	-	-	-	GLO	GLO	GLO	GLO	GLO
Specific data used	>90%																
Variation – sites	<3%																

X: Module declared
ND: Module not declared (such a declaration shall not be regarded as an indicator of a zero result)

<u>Scenarios for module C1-C4 and D</u>

- The scenarios are currently in use and are representative for one of the most probable alternatives.
- De-construction demolition (C1) : In addition to building materials, the product can be used for various applications, such as automobile, heavy equipment, etc. However, since this EPD study follows PCR 2019:14 for construction products, it was limited to cases where the product was used as a building material in the C1 scenario setting. Energy consumption of a demolition process is on average 10kWh/m2 (Bozdag, Ö & Seçer, M. 2007). The average mass of a reinforced concrete building is about 1000 kg/m2. Therefore, energy consumption during demolition is 10kWh per declared unit, 1 metric ton. A conservative assumption has been made that the energy consumed during demolition of a steel building is the same as that of a concrete building. The source of energy is diesel fuel used by industrial equipments. Both environmental effects on diesel production and combustion were considered.
- Transport (C2) : It is assumed that 100% of the waste is collected and transported to the waste treatment centre. Transportation distance to the waste treatment cetre is assumed as 300 km and the transportation method is assumed to be lorry, Euro 0-6 mix.
- Waste processing (C3) : Approximately 85% of steel is assumed to be recycled based on World Steel Association, 2020.
- Disposal (C4) : It is assumed that the remaining 15 % of steel is buried to landfill for final disposal.

- Reuse-Recovery-Recycling-potential (D) : During the recycling process, 85% of the end-of-life product is converted into recycled steel. The following DB is connected to module D. 'GLO: credit for recycling of steel scrap Sphera <Mfg>'

Excluded life cycle stages: Use phase are not included following the PCR.

Cut-Off Rule: Criteria were set out in the original study for the recording of material flows and to avoid the need to pursue trivial inputs/outputs in the system. Life cycle inventory data shall according to EN 15804 include a minimum of 95% of total inflows (mass and energy) per module. In addition, this PCR applies the expanded cut-off rule of ISO 21930, which says that at least 95% of the environmental impact per module shall be included as well. It is calculated by using GWP coefficient. The inflows of raw material excluded according to the cut-off rule are as follows; Ferro alloy (Fe-Mn, Fe-Mo, Fe-Nb, Fe-Ti, Fe-V, Fe-B, Fe-S), rubber, Wire (N-wire, S-wire, Ca-Si wire), Oil (Hydraulic working fluid, lubricant, grease), Fluorite, Absorbent, Paint, Rice husk.

Assumptions and Limitations

- Waste: mineral oil DB (RoW: market for waste mineral oil ecoinvent 3.8) was used in the DB for recycling waste lubricant, waste oil, and waste mineral oil because their main component was mineral oil.
- Allocation: All scraps generated in the production process of the product are recycled and are not subject to allocation. Among the internally recycled scrap, for the scrap that goes through an additional process called BRM, the primary data was collected to include its environmental impact.
- Manufacturing process: Due to the characteristics of steel products, processes such as rolling, forging, correction, and secondary processing are complicatedly connected. Due to the large number of cases in which products can be produced, the process flow corresponding to the top 90% of production volume was identified by reflecting the opinions of the production manager and the research institute, and this was selected as a representative process.
- Transportation: If the transport distance such as iron scrap or anthracite is not known accurately, it is assumed that the inland transport distance from domestic and overseas is 150km. It is half of the 300km distance between Seoul and Busan where are big cities and are located almost at the both extremes in South Korea.
- Cut-off: When cutting off by energy standards, if the secondary data among the raw material components used in the steelmaking process do not exactly match, it was replaced by a similar DB with the same use or the same raw material extraction method.

Allocation Rules:

1. Physical or Economic allocations were made for each process. Physical allocation was made when the final product did not come out and the semi-finished products came out. When the final product and

the co-products are produced, economic allocation was made in accordance with the following 6.4.3.2 of EN15804 criteria.

Processes generating a very low contribution to the overall revenue may be neglected. Joing co-product allocation shall be allocated as follows:

— Allocation shall be based on physical properties (e.g. mass, volume) when the difference in revenue from the co-products is low;
— In all other cases allocation shall be based on economic values;

NOTE 1 Contributions to the overall revenue of the order of 1% or less is regarded as very low. A difference in revenue of more than 25% is regarded as high.

2. If waste, utilities (compressed air, outside purchased oxygen, etc.), industrial water, and other by-products are used or discharged in various processes, these values are difficult to separate per unit process. Therefore they are allocated according to the production volume of those processes.

Allocation is required if some material, energy, and waste data cannot be measured separately for the product under investigation. PCR 2019:14 (v1.3.1) Sections 4.5.1 and 4.5.2 provide guidance on the allocation of co-products and waste, respectively, and as such are further specifications of Sections 6.4.3.2 and 6.4.3.3 of EN 15804. EN 15804 defines co-products as “any of two or more marketable materials, products or fuels from the same unit process, but which is not the object of assessment” and waste as a “substance or object which the holder discards or intends or is required to discard”.
Pre-consumer scrap, leaving the product system from modules A1-A3, shall be allocated as a co-product, see Section 4.5.1. Because no omission of inputs or outputs through allocation shall be done, scrap entering a product system shall come with an environmental burden if it originated from modules A1- A3 of a previous product system, and the calculation of this burden shall be based co-product allocation.

The allocation of co-products follows the PCR 2019:14 and Section 6.4.3.2 in EN15804 in the following order;

1. Allocation should be avoided.
2. Allocation should be based on physical properties when (i) there is a relevant underlying physical relationship between the products and co-products, and (ii) the difference in revenue per mass (or per energy unit in case of electricity, heat or similar) from the products and co-products is low.
3. In all other cases, allocation shall be based on economic values of the products and co-products when they leave the unit process.

According to 4.5.2 of PCR 2019:14, The system boundary to the subsequent product system is set where the waste reaches the end-of-waste state. Unlike electric arc furnace slag and scale, Waste metal is not a co-product and reaches the waste metal state at the end of the system. At the system boundary, cut-off allocation shall be applied, i.e., all unit processes before the point of end-of-waste shall be assigned to the product system generating the waste and all unit processes after the point of end-of-waste shall be assigned to the subsequent product system.

Content information

Product components	Weight, kg	Post-consumer material, weight-%	Biogenic material, weight-% and kg C/kg
Fe	920~980	-	0 resp. 0
C, Si, Mn, Cr etc.	20~80	-	0 resp. 0
TOTAL	1000	-	0 resp. 0
Packaging materials	**Weight, kg**	**Weight-% (versus the product)**	**Weight biogenic carbon, kg C/kg**
Steel band, Steel wire, Clip (Fe, Carbon steel)	6.13E-01	0.0613%	0
Wrapping paper (PP >= 95 ~ <= 100)	2.41E-02	0.0024%	0
Vinyl (LDPE)	5.42E-03	0.0005%	0
VCI vinyl (PE 58~75, Benzoic acid 14~24 etc)	2.35E-03	0.0002%	0
Paper pipe (Paper)	2.43E-02	0.0024%	5.00E-01
Corrugated cardboard	2.83E-03	0.0003%	5.00E-01
TOTAL	6.72E-01	0.0672%	1.35E-02

Dangerous substances from the candidate list of SVHC for Authorisation	EC No.	CAS No.	Weight-% per declared unit
None			

Materials	Post-consumer material, weight-%	Internal scrap-%
Steel Scrap	84.0%	8.0%

Results of the environmental performance indicators

The LCIA results for 1 tonne of Round Bar are given.

Both raw materials and packaging have been considered to calculate the environmental impacts.

The estimated impact results are only relative statements, which do not indicate the endpoints of the impact categories, exceeding threshold values, safety margins and/or risks.

Potential environmental impact – mandatory indicators according to EN 15804

PARAMETER		UNIT	A1-A3	C1	C2	C3	C4	D
Global warming potential (GWP)	TOTAL	kg CO_2 eq.	1.19E+03	3.67E+00	8.38E+01	7.17E+00	7.76E-01	-1.18E+02
	Fossil	kg CO_2 eq.	1.19E+03	3.67E+00	8.20E+01	7.07E+00	7.75E-01	-1.19E+02
	Biogenic	kg CO_2 eq.	3.04E+00	0	1.34E+00	7.96E-02	7.28E-04	7.00E-01
	Land use and land transformation	kg CO_2 eq.	9.47E-01	0	4.74E-01	2.14E-02	7.30E-04	-1.58E-02
Ozone Depletion		kg CFC-11 eq.	4.10E-05	2.05E-10	5.09E-12	2.33E-06	3.20E-07	1.59E-10
Acidification		Mole of H+ eq.	5.10E+00	5.52E-02	5.82E-01	5.89E-02	7.43E-03	-2.91E-01
Eutrophication aquatic freshwater		kg P eq.	5.60E-01	2.26E-06	2.54E-04	7.52E-04	7.23E-05	-2.77E-05
Eutrophication marine		kg N eq.	1.35E+00	2.22E-02	2.88E-01	2.08E-02	2.58E-03	-4.67E-02
Eutrophication terrestrial		Mole of N eq.	1.39E+01	2.43E-01	3.19E+00	2.26E-01	2.83E-02	-4.18E-01
Formation of photochemical ozone		kg NMVOC eq.	3.55E+00	6.47E-02	5.42E-01	6.53E-02	8.23E-03	-1.90E-01
Depletion of abiotic resources - minerals & metals		kg Sb eq.	3.99E-03	0	7.13E-06	1.99E-05	1.80E-06	-6.72E-04
Depletion of abiotic resources - fossil		MJ	1.86E+04	1.02E+02	1.14E+03	1.66E+02	2.22E+01	-1.18E+03
Water Use		m3 eq.	1.75E+02	0	7.62E-01	5.92E+00	1.02E+00	-8.01E+00

Additional mandatory and voluntary impact category indicators

Results per functional or declared unit							
Indicator	**Unit**	**A1-A3**	**C1**	**C2**	**C3**	**C4**	**D**
GWP-GHG[1]	kg CO_2 eq.	1.19E+03	3.67E+00	8.26E+01	7.09E+00	7.76E-01	-1.19E+02

Use of resources according to EN 15804

PARAMETER	UNIT	A1-A3	C1	C2	C3	C4	D
Use of renewable primary energy (PERE)	MJ	6.66E+02	0	6.45E+01	2.05E+00	1.92E-01	4.66E+01
Primary energy resources as raw materials (PERM)	MJ	2.60E+03	0	0	0	0	0
Total use of renewable primary energy resources (PERT)	MJ	6.66E+02	0	6.45E+01	2.05E+00	1.92E-01	4.66E+01
Use of non-renewable primary energy (PENRE)	MJ	1.86E+04	1.02E+02	1.14E+03	1.66E+02	2.22E+01	-1.18E+03
Non-renewable primary energy resources used as raw materials (PENRM)	MJ	3.66E-01	0	0	0	0	0
Total use of non-renewable primary energy resources (PENRT)	MJ	1.86E+04	1.02E+02	1.14E+03	1.66E+02	2.22E+01	-1.18E+03
Input of secondary material (SM)	Kg	1.26E+03	0	0	0	0	0
Use of renewable secondary fuels (RSF)	MJ	0	0	0	0	0	0
Use of non-renewable secondary fuels (NRSF)	MJ	0	0	0	0	0	0
Use of net fresh water (FW)	m3 eq.	4.12E+00	0	7.30E-02	1.38E-01	2.36E-02	-1.20E+01

[1] This indicator accounts for all greenhouse gases except biogenic carbon dioxide uptake and emissions and biogenic carbon stored in the product. As such, the indicator is identical to GWP-total except that the CF for biogenic CO_2 is set to zero.

Waste production and output flows

PARAMETER	UNIT	A1-A3	C1	C2	C3	C4	D
Hazardous Waste Disposed	kg	1.02E-07	0	5.45E-09	0	0	-8.83E-06
Non-hazardous Waste Disposed	kg	4.67E-01	0	1.63E-01	0	0	1.43E+01
Radioactive Waste Disposed	kg	1.57E-02	0	1.40E-03	0	0	1.29E-04
Components for Re-use	kg	1.14E+02	0	0	0	0	0
Material for Recycling (MFR)	kg	1.92E+02	0	0	0	0	6.84E+01
Materials for Energy Recovery (MER)	kg	0	0	0	0	0	0
Exported Electricity Energy (EEE)	MJ	0	0	0	0	0	0
Exported Thermal Energy (EET)	MJ	0	0	0	0	0	0

Information on biogenic carbon content

Results per declared unit		
BIOGENIC CARBON CONTENT	**Unit**	**QUANTITY**
Biogenic carbon content in product	kg C	8.56E-01
Biogenic carbon content in packaging	kg C	3.70E-03

Note: 1 kg biogenic carbon is equivalent to 44/12 kg CO_2.

Additional environmental impact

PARAMETER	UNIT	A1-A3	C1	C2	C3	C4	D
Particulate Matter emissions (PM)	Disease incidence	5.39E-05	2.08E-07	3.16E-06	1.09E-06	1.45E-07	-2.73E-06
Ionizing radiation, human health (IRP)	kBq U235 eq.	1.77E+02	1.78E-18	2.05E-01	7.44E-01	9.80E-02	2.67E+00
Eco-toxicity (freshwater) (ETP-fw)	CTUe	8.08E+03	1.47E+02	7.96E+02	4.82E+01	5.83E+00	-6.20E+01
Human toxicity, cancer effects (HTP-c)	CTUh	2.38E-05	2.39E-09	1.59E-08	3.67E-09	3.54E-10	4.85E-08
Human toxicity, non-cancer effects (HTP-nc)	CTUh	1.63E-05	1.46E-07	6.88E-07	4.85E-08	3.90E-09	2.32E-07
Land usd related impacts / Soil quality (SQP)	dimensio nless	3.26E+03	0	3.91E+02	2.96E+02	4.63E+01	-1.53E+01

When using the results of modules A1-A3, the results of module C should also be considered.

Indicators describing environmental impacts based on Life Cycle Imact Assessment (LCIA)

Core environmental impact indicators

Impact category	Indicator	Unit (Expressed per functional unit or per declared unit)
Climate change – total [a]	Global Warming Potential total (GWP-total)	kg CO_2 eq.
Climate change - fossil	Global Warming Potential fossil fuels (GWP-fossil)	kg CO_2 eq.
Climate change - biogenic	Global Warming Potential biogenic (GWP-biogenic)	kg CO_2 eq.
Climate change - land use and land use change [b]	Global Warming Potential land use and land use change (GWP-luluc)	kg CO_2 eq.
Ozone Depletion	Depletion potential of the stratospheric ozone layer (ODP)	kg CFC 11 eq.
Acidification	Acidification potential, Accumulated Exceedance (AP)	mol H^+ eq.
Eutrophication aquatic freshwater	Eutrophication potential, fraction of nutrients reaching freshwater end compartment (EP-freshwater)	kg PO_4 eq.
Eutrophication aquatic marine	Eutrophication potential, fraction of nutrients reaching marine end compartment (EP-marine)	kg N eq.
Eutrophication terrestrial	Eutrophication potential, Accumulated Exceedance (EP-terrestrial)	mol N eq.
Photochemical ozone formation	Formation potential of tropospheric ozone (POCP);	kg NMVOC eq.
Depletion of abiotic resources - minerals and metals [c d]	Abiotic depletion potential for non-fossil resources (ADP-minerals&metals)	kg Sb eq.
Depletion of abiotic resources - fossil fuels [c]	Abiotic depletion for fossil resources potential (ADP-fossil)	MJ, net calorific value
Water use	Water (user) deprivation potential, deprivation-weighted water consumption (WDP)	m3 world eq. deprived

a The total global warming potential (GWP-total) is the sum (see C.2) of
— GWP-fossil
— GWP-biogenic
— GWP-luluc

b It is permitted to omit GWP-luluc as separate information if its contribution is < 5 % of GWP-total over the declared modules excluding module D.

c The abiotic depletion potential is calculated and declared in two different indicators:
— ADP-minerals&metals include all non-renewable, abiotic material resources (i.e. excepting fossil resources)
— ADP-fossil include all fossil resources and includes uranium.

d ultimate reserve model of the ADP-minerals&metals model

Core environmental impact indicators

Impact category	Indicator	Unit (Expressed per functional unit or per declared unit)
Particulate Matter emissions	Potential incidence of disease due to PM emissions (PM)	Disease incidence
Ionizing radiation, human health	Potential Human exposure efficiency relative to U235 (IRP)	kBq U235 eq.
Eco-toxicity (freshwater)	Potential Comparative Toxic Unit for ecosystems (ETP-fw)	CTUe
Human toxicity, cancer effects	Potential Comparative Toxic Unit for humans (HTP-c)	CTUh
Human toxicity, non-cancer effects	Potential Comparative Toxic Unit for humans (HTP-nc)	CTUh
Land use related impacts/ Soil quality	Potential soil quality index (SQP)	dimensionless

Classification of disclaimers to the declaration of core and additional environmental impact indicators

ILCD classification	Indicator	Disclaimer
ILCD Type 1	Global warming potential (GWP)	None
	Depletion potential of the stratospheric ozone layer (ODP)	None
	Potential incidence of disease due to PM emissions (PM)	None
ILCD Type 2	Acidification potential, Accumulated Exceedance (AP)	None
	Eutrophication potential, Fraction of nutrients reaching freshwater end compartment (EP-freshwater)	None
	Eutrophication potential, Fraction of nutrients reaching marine end compartment (EP-marine)	None
	Eutrophication potential, Accumulated Exceedance (EP-terrestrial)	None
	Formation potential of tropospheric ozone (POCP)	None
	Potential Human exposure efficiency relative to U235 (IRP)	1
ILCD Type 3	Abiotic depletion potential for non-fossil resources (ADP-minerals&metals)	2
	Abiotic depletion potential for fossil resources (ADP-fossil)	2
	Water (user) deprivation potential, deprivation-weighted water consumption (WDP)	2
	Potential Comparative Toxic Unit for ecosystems (ETP-fw)	2
	Potential Comparative Toxic Unit for humans (HTP-c)	2
	Potential Comparative Toxic Unit for humans (HTP-nc)	2
	Potential Soil quality index (SQP)	2

Disclaimer 1 – 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.

Disclaimer 2 – The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.

Parameters describing resource use

Parameter	Unit(expressed per functional unit or per declared unit)
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ, net calorific value
Use of renewable primary energy resources used as raw materials	MJ, net calorific value
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ, net calorific value
Use of non-renewable primary energy excluding nonrenewable primary energy resources used as raw materials	MJ, net calorific value
Use of non-renewable primary energy resources used as raw materials	MJ, net calorific value
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ, net calorific value
Use of secondary material	kg
Use of renewable secondary fuels	MJ, net calorific value
Use of non-renewable secondary fuels	MJ, net calorific value
Net use of fresh water	m^3

Other environmental information describing waste categories

Parameter	Unit(expressed per functional unit or per declared unit)
Hazardous waste disposed	kg
Non-hazardous waste disposed	kg
Radioactive waste disposed	kg

Environmental information describing output flows

Parameter	Unit(expressed per functional unit or per declared unit)
Components for re-use	kg
Materials for recycling	kg
Materials for energy recovery	kg
Exported energy	MJ per energy carrier

Differences versus previous versions

2024-01-10 Version 1

2024-07-08 Version 1.1
The LCA results from Module A1-A3 have been modified due to the data input error into Gabi software.

References

- The International EPD® System, The International EPD® System is a programme for type III environmental declarations, maintaining a system to verify and register EPD®s as well as keeping a library of EPD®s and PCRs in accordance with ISO 14025, www.environdec.com
- Product Category Rules (PCR): Construction products 2019:14, version 1.3.1
- General Programme Instructions of the International EPD® System. Version 4.0
- ISO 14020:2000 Environmental labels and declarations - General principles
- ISO 14025:2006 Environmental labels and declarations - Type III environmental declarations - Principles and procedures
- ISO 14040:2006 Environmental management- Life cycle assessment - Principles and framework
- ISO 14044:2006 Environmental management - Life cycle assessment - Requirements and guidelines
- O. Bozdag and M. Secer, “Energy Consumption of RC Buildings during Their Life Cycle,” Sustainable Construction, Materials and Practices: Challenge of the Industry for the New Millennium, Minho, 12-14 September 2007, pp. 480-487.
- World Steel Association - Life Cycle Inventory study report, 2020 data release, 2021