epddanmark

ECO PLATFORM EPD VERIFIED

Owner:	Randers Tegl A/S
No.:	MD-24032-EN
EPD tool:	T24001
Tool version:	Version 1.0
Issued:	01-03-2024
Valid to:	01-03-2029

3rd PARTY **VERIFIED**

EPD

VERIFIED ENVIRONMENTAL PRODUCT DECLARATION | **ISO 14025 & EN 15804**

Owner of declaration
Randers Tegl A/S
Mineralvej 4
9220 Aalborg Øst
CVR: 20400234

Programme
EPD Danmark
www.epddanmark.dk

☐ Industry EPD
☒ Product EPD

Declared products:
RT510 DK-NF BS, RT515 DK-NF BS, RT550 UK-NF BS

Number of declared product variations: 3

Product use:
Bricks are used to build walls, pillars and partitions

Declared or functional unit
1 tonne of clay product with an expected average reference service life of 150 years.

Year of production site data (A3)
2022

Declaration developed using Randers Tegl EPD tool, T24001 V.1.0. Data collection, processing and registration done by: Kresten Ejlskov Hansen

Reviewed by:
☒ internal ☐ external

Reviewer (internal control):

Jakob Steenild, Randers Tegl A/S

Issued: 01-03-2024
Valid to: 01-03-2029

Basis of calculation
This EPD is developed in accordance with the European standard EN 15804:2012+A2:2019.

Comparability
EPDs of construction products may not be comparable if they do not comply with the requirements in EN 15804:2012+A2:2019. EPD data may not be comparable if the datasets used are not developed in accordance with EN 15804:2012+A2:2019 and if the background systems are not based on the same database.

Validity
This EPD has been verified in accordance with ISO 14025:2010 and is valid for 5 years from the date of issue.

Use
The intended use of an EPD is to communicate scientifically based environmental information for construction products, for the purpose of assessing the environmental performance of buildings.

EPD type
☐Cradle-to-gate with modules C1-C4 and D
☐Cradle-to-gate with options, modules C1-C4 and D
☒Cradle-to-grave and module D
☐Cradle-to-gate
☐Cradle-to-gate with options

CEN standard EN 15804:2012+A2:2019 serves as the core PCR

Independent verification of the tool on which declaration and data is based, according to EN ISO 14025:2010

☐ internal ☒ external

Third party verifier:

Mirko Miseljic, FORCE Technology Denmark

Martha Katrine Sørensen

EPD Danmark

Life cycle stages and modules (MND = module not declared)																
Product			Construction process		Use							End of life				Beyond the system boundary
Raw material supply	Transport	Manufacturing	Transport	Installation process	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Re-use, recovery and recycling potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Product information

Product Description:

The main product components are shown in the table below.

Material	Weight-% of declared product
Barium Carbonate	0,30%
Chamotte	12,34%
Clay	76,59%
Clay Powder	3,36%
Engobe	0,16%
Manganese Oxide	0%
Sand	7%

Product Packaging:

The composition of the sales- and transport packaging of the product is shown in the table below.

Material	Weight-% of packaging
Pallet Strips	4,2%
Paper	10,2%
LDPE Foil	21,6%
Brick Pallet	64,0%

Reference Service Life (RSL):

The reference service life (RSL) is declared to be a default period of 150 years as detailed in the Internal Guidance Document on TBE PCR for Clay Construction Products (2020), section 3, page 7.

Representativity:

This declaration, including data collection and the modelled foreground system including results, represents the production of the declared product manufactured by Randers Tegl A/S at the site Hammershøj. Product specific data are based on average values collected for the year, 2022.

Background data is based on the LCA database, ecoinvent 3.9.1, which was updated in 2022 and complies with EN 15804:2012 +A2:2019, section 6.3.8.2, by being less than 5 years old. Generally, the applied background datasets are of a reasonably high quality and were updated in 2022. Most datasets are geographically accurate for the given country or region representing activities in Denmark (DK), Germany (DE), France (FR) or Europe (RER) as a whole. Where data quality has been geographically inaccurate, adjustments to the datasets have been performed to ensure representability.

Essential characteristics (CE):

Bricks and tiles are covered by the harmonized technical specifications of following standards:
- Bricks: EN 771-1:2011+A1:2015
- Tiles: EN 1304:2013

The main technical specifications of the declared products are listed in the table below:

Properties	Value	Unit
Weight	g/p	2376,7
Product per 1 m2	p/m2	62

Further technical information and a declaration of performance (DOP) can be acquired on the website of the manufacturer:
(https://www.randerstegl.com)

Hazardous Substances:

The declared products by Randers Tegl A/S, do not contain any substances listed in the "Candidate List of Substances of Very High Concern for Authorization"

(https://echa.europa.eu/da/candidate-list-table)

Geographical Scope:

The geographical scope of this study is Denmark (DK).

Picture of product(s)

LCA Background

Declared Unit:

As prescribed by the Internal Guidance Document on *TBE PCR for Clay Construction Products* (2020), section 3, page 7, the declared unit (DU) is defined as:

- 1 ton of clay product with an expected average reference service life of 150 years

The LCI and LCIA results in this EPD relates to 1 ton of clay product with an additional converting factor to 1 m².

Name	Value	Unit
Declared unit	1	ton
Area density	147,44	kg/m^2
Conversion factor to 1 m2	0,1474	-
Conversion factor to 1 kg	0,001	-

PCR:

This EPD is developed according to the core rules for the product category of construction products in EN 15804:2012 +A2:2019, and the following complementary standard by Tiles & Brick Europe:

- Internal Guidance Document on TBE PCR for Clay Construction Products (2020)

Guarantee of Origin – Certificates:

The declared product is manufactured (A3) using guarantees of origin (GOs) for 100% of electricity (wind, unspecified) and 100% of natural gas consumption by biomethane-certificates

Foreground system:

The production of Randers Tegl A/S is modelled based on site-specific data. The electricity consumption is covered by RECS-certificates representing unspecified wind power, which has been modelled as the average distribution of on- and offshore sources in 2020 (WindEurope, 2021). In cases where geographical adjustments have been performed to the electricity mix of datasets pertaining to raw materials (A1), residual mixes have been applied. The remaining activities are covered by average supply mixes representing individual countries (e.g. DK and DE) or regions (e.g. EU) depending on the specific processes of the value chain.

Background system:

The database, ecoinvent 3.9.1 (published in 12-2022) is utilized for the background system. As a result, both upstream- and downstream activities are based on average supply mixes for the specific country or region depending on the given dataset.

Allocation Principles:

Allocation have been made in accordance with EN 15804:2012+A2:2019, section 6.4.3. In this regard, allocation has been avoided to the extent that is possible by dividing unit processes into different sub-processes using site specific measurements concerning CaCO3-content and process heat during firing of the declared product in a tunnel kiln, which has been subtracted the annual consumption at each factory.

Residual energy at the site, which cannot be directly attributed to a given product and thus sub-divided, has been allocated by fired mass in order to reflect the underlying physical relationship of products during manufacturing (A3). As a general principle, the sum of allocated inputs and outputs of the system are equal to the annual consumption of a given site thereby preserving the mass balance and no inputs or outputs are double counted or omitted from the model.

System Boundary

This EPD is based on a cradle-to-grave scope, and covers the life cycle modules, A1-A3, A4-A5, B1-B7, C1-C4, and D, in which 100 weight-% has been accounted for.

The general rules for the exclusion of inputs and outputs follow the requirements specified in EN 15804:2012+A2:2019, section 6.3.6, where the total of neglected input flows per modules shall be a maximum of 5% of energy usage and mass as well as 1% of renewable and non-renewable primary energy usage and mass for unit processes. In addition, particular care has been taken to include materials and flows known to have the potential to cause significant emissions into air, water, and soul related to the environmental indicators assessed in this study. In this respect, conservative assumptions in combination with plausibility considerations and expert judgement has been exercised to demonstrate compliance with this criterion.

Product stage (A1-A3):
The product stage (A1-A3) comprises the acquisition of all raw materials, energy consumption, and transport to the factory as well as packaging and waste processing up to the 'end-of-waste' state or final disposal. The LCA results are declared in aggregated form meaning that the sub-modules A1, A2, and A3 are declared as one – Module A1-A3.

The production process begins with the extraction and preparation of raw materials primarily consisting of clay. Materials are excavated from quarries and blended with various secondary additives to achieve the desired aesthetic and properties. The prepared clay mixture is shaped into the desired form and dried to remove excess moisture. Subsequently, the dried product is subjected to high temperature firing in kilns, which hardens the clay, making it durable and resistant to weather and external forces. Once the declared product passes quality control, it is packaged and prepared for distribution.

Construction stage (A4-A5):
The transportation between Randers Tegl A/S and the building site can generally be classified as batches through direct sales with an assumed average transportation distance of 50 km as listed in Internal Guidance Document on TBE PCR for Clay Construction Products (2020), section 5, page 18.

The construction stage includes the provision of all materials, products and energy, as well as waste processing up to the end-of-waste state or disposal of final residues during the construction process stage. For the installation, it is assumed that the majority of the process is done manually, with only a minimal to negligible requirement for electricity and water, as stated in Clay Construction Products by TBE (2020), Section 5.2, page 13. Additionally, the module includes all impacts and aspects related to any losses during this construction process stage. A general loss of 3% mass is generally expected during the construction stage (A4-A5). The waste flow from the declared product is categorized as inert waste, and it is transported to a landfill as construction waste.

Use stage (B1-B7)
The use phase (B1-B7) relates to the usage of the declared product throughout its lifespan in the construction project.

As specified in EN 15804:2012+A2:2019, section 6.2.4, page 17, this includes the transportation of all materials, products, and related energy and water consumption, as well as the handling of waste or disposal of final residues. As described in the the *Internal Guidance Document on TBE PCR for Clay Construction Products* (2020), section 5.3, page 14, clay products do not generate environmental impacts during the use phase (B1-B7). Consequently, the environmental impact for these information modules (B1-B7) are reported as 0.00E+00 (previously MNR).

End of Life (C1-C4):
Concerning the end-of-life stage (C1-C4), a range of national scenarios are used based on data from Miljøstyrelsen (2022) and the *Internal Guidance Document on TBE PCR for Clay Construction Products* (2020).

As prescribed by EN 15804:2012 +A2:2019, section 6.3.9, all scenarios are realistic and representative of one of the most likely alternatives. The scenarios do not include processes or procedures that are not currently in use or have not proven to be practical. Limited material flow and resource consumption is associated with the activities of deconstruction and demolition (C1). For this reason, it is specified in the Internal Guidance Document on TBE PCR for Clay Construction Products (2020), section 5.4, page 14, that the environmental impacts attributed to the module are considered insignificant and, are therefore omitted from the life cycle assessment (LCA). As a general assumption, the generic end-of-life transport scenarios provided by the Internal Guidance Document on TBE PCR for Clay Construction Products (2020) are used. Data concerning the transport of construction and demolition waste from the construction site to the final destination (C2) is based on a third-party verified report by ASRO (2008).

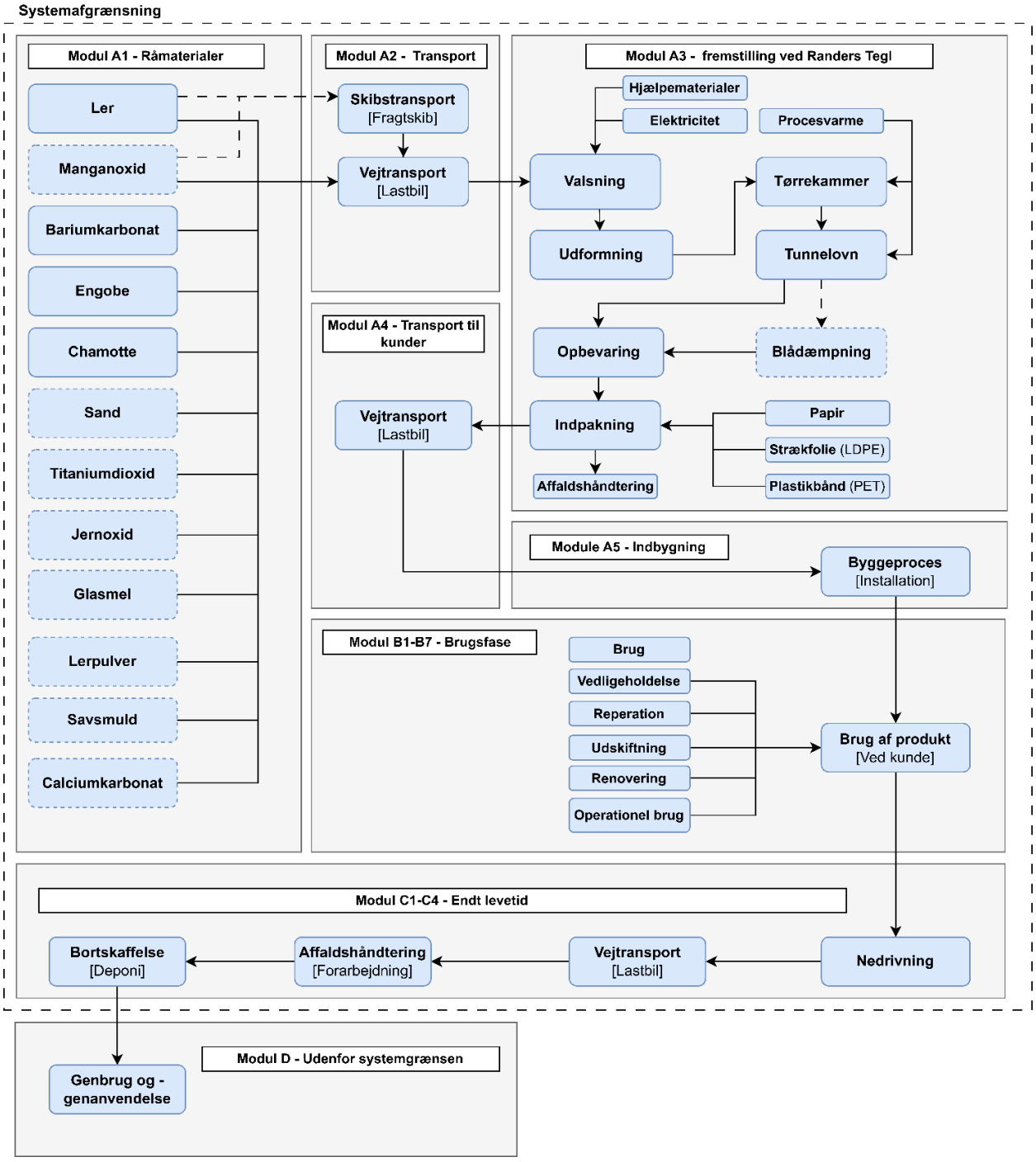
As recommended by the Internal Guidance Document on TBE PCR for Clay Construction Products (2020), section 5.6, page 14, the life cycle inventory (LCI) for waste management (C3) is developed based on a comprehensive national scenario for Denmark. It is expected, that 99% of construction waste is recycled, while the remaining 1% is sent to a landfill (C4). The recycling of clay waste takes place through the crushing of the material to create recycled ballast – a material mixture of concrete and brick.

Re-use, recovery & recycling potential (D):

Module D includes the reuse, recovery and/or recycling potentials of the declared product, expressed as net impacts and benefits. This primarily pertains to the substitution of gravel from the recycling of crushed bricks and energy produced in from the incineration of packaging.

Electricity generated from the municipal incineration at the CHP plant is assumed to replace an average Danish electricity mix, while thermal energy is set to displace an average district heating market in Denmark for the year 2021 (DEA, 2022).

Flowdiagram



LCA Results

RT550 UK-NF BS

ENVIRONMENTAL IMPACTS PER TONNES RT550 UK-NF BS										
Parameter	**Unit**	**A1-A3**	**A4**	**A5**	**B1-B7**	**C1**	**C2**	**C3**	**C4**	**D**
GWP-total	[kg CO_2 eq.]	2,84E+02	5,32E+00	7,62E+00	0,00E+00	0,00E+00	7,41E+00	3,46E+00	5,51E-02	-5,75E+00
GWP-fossil	[kg CO_2 eq.]	2,68E+02	5,32E+00	3,21E+00	0,00E+00	0,00E+00	7,37E+00	3,46E+00	5,49E-02	-5,54E+00
GWP-biogenic	[kg CO_2 eq.]	1,61E+01	4,08E-03	4,38E+00	0,00E+00	0,00E+00	6,67E-03	7,93E-04	1,69E-04	-1,99E-01
GWP-luluc	[kg CO_2 eq.]	7,79E-02	2,49E-03	2,77E-04	0,00E+00	0,00E+00	3,58E-03	3,89E-04	1,08E-05	-7,90E-03
ODP	[kg CFC 11 eq.]	2,44E-05	1,16E-07	1,65E-08	0,00E+00	0,00E+00	1,61E-07	5,50E-08	1,90E-09	-1,03E-07
AP	[mol H+ eq.]	9,68E-01	1,79E-02	3,10E-03	0,00E+00	0,00E+00	2,41E-02	3,21E-02	3,54E-04	-3,86E-02
EP-freshwater	[kg PO4 eq.]	2,22E-02	3,78E-04	6,04E-05	0,00E+00	0,00E+00	5,18E-04	1,07E-04	2,56E-06	-2,27E-03
EP-marine	[kg N eq.]	1,69E-01	6,19E-03	1,28E-03	0,00E+00	0,00E+00	8,28E-03	1,49E-02	1,54E-04	-1,05E-02
EP-terrestrial	[mol N eq.]	2,08E+00	6,54E-02	1,32E-02	0,00E+00	0,00E+00	8,75E-02	1,61E-01	1,66E-03	-1,39E-01
POCP	[kg NMVOC eq.]	7,40E-01	2,78E-02	4,82E-03	0,00E+00	0,00E+00	3,60E-02	4,78E-02	6,58E-04	-3,57E-02
ADPm[1]	[kg Sb eq.]	1,09E-03	1,43E-05	1,57E-06	0,00E+00	0,00E+00	2,37E-05	1,21E-06	5,78E-08	-5,58E-05
ADPf[1]	[MJ]	5,86E+03	7,77E+01	1,07E+01	0,00E+00	0,00E+00	1,05E+02	4,53E+01	1,40E+00	-7,15E+01
WDP[1]	[m3]	2,76E+01	3,71E-01	5,20E-02	0,00E+00	0,00E+00	4,27E-01	9,80E-02	5,03E-03	2,02E-01
Caption	GWP-total = Globale Warming Potential - total; GWP-fossil = Global Warming Potential - fossil fuels; GWP-biogenic = Global Warming Potential - biogenic; GWP-luluc = Global Warming Potential - land use and land use change; ODP = Ozone Depletion; AP = Acidifcation; EP-freshwater = Eutrophication – aquatic freshwater; EP-marine = Eutrophication – aquatic marine; EP-terrestrial = Eutrophication – terrestrial; POCP = Photochemical zone formation; ADPm = Abiotic Depletion Potential – minerals and metals; ADPf = Abiotic Depletion Potential – fossil fuels; WDP = water use									
	The numbers are declared in scientific notation, e.g. 1.95E+02. This number can also be written as: 1.95*100 or 195, while 1.12E-11 is the same as 1.12*10^-11 or 0.0000000000112.									
Disclaimer	[1] The results of this environmental indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.									

ADDITIONAL ENVIRONMENTAL IMPACTS PER TONNES										
Parameter	**Unit**	**A1-A3**	**A4**	**A5**	**B1-B7**	**C1**	**C2**	**C3**	**C4**	**D**
PM	[Disease incidence]	1,63E-05	5,37E-07	6,38E-08	0,00E+00	0,00E+00	5,88E-07	8,94E-07	8,94E-09	-6,48E-07
IRP[2]	[kBq U235 eq.]	5,18E+00	9,81E-02	2,32E-02	0,00E+00	0,00E+00	1,40E-01	2,15E-02	1,33E-03	-6,97E-01
ETP-fw[1]	[CTUe]	4,60E+02	3,73E+01	6,03E+00	0,00E+00	0,00E+00	5,18E+01	2,16E+01	5,89E-01	-3,03E+01
HTP-c[1]	[CTUh]	1,15E-07	2,30E-09	3,72E-10	0,00E+00	0,00E+00	3,35E-09	1,06E-09	1,86E-11	-7,66E-09
HTP-nc[1]	[CTUh]	1,62E-06	5,57E-08	1,07E-08	0,00E+00	0,00E+00	7,37E-08	7,26E-09	2,45E-10	-8,36E-08
SQP[1]	-	8,56E+02	7,87E+01	1,24E+01	0,00E+00	0,00E+00	6,24E+01	3,05E+00	2,88E+00	-1,74E+02
Caption	PM = Particulate Matter emissions; IRP = Ionizing radiation – human health; ETP-fw = Eco toxicity – freshwater; HTP-c = Human toxicity – cancer effects; HTP-nc = Human toxicity – non cancer effects; SQP = Soil Quality (dimensionless)									
	The numbers are declared in scientific notation, e.g. 1.95E+02. This number can also be written as: 1.95*100 or 195, while 1.12E-11 is the same as 1.12*10^-11 or 0.0000000000112.									
Disclaimer	[1] The results of this environmental indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.									
	[2] 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.									

RESOURCE USE PER TONNES										
Parameter	**Unit**	**A1-A3**	**A4**	**A5**	**B1-B7**	**C1**	**C2**	**C3**	**C4**	**D**
PERE	[MJ]	7,90E+02	1,13E+00	2,60E-01	0,00E+00	0,00E+00	1,62E+00	2,57E-01	2,77E-02	-3,94E+01
PERM	[MJ]	3,79E+01	0,00E+00	-3,79E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT	[MJ]	8,28E+02	1,13E+00	-3,77E+01	0,00E+00	0,00E+00	1,62E+00	2,57E-01	2,77E-02	-3,94E+01
PENRE	[MJ]	9,00E+02	7,77E+01	1,07E+01	0,00E+00	0,00E+00	1,05E+02	4,53E+01	1,40E+00	-7,15E+01
PENRM	[MJ]	3,29E+01	0,00E+00	-3,29E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PENRT	[MJ]	9,33E+02	7,77E+01	-2,22E+01	0,00E+00	0,00E+00	1,05E+02	4,53E+01	1,40E+00	-7,15E+01
SM	[kg]	1,18E+02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
RSF	[MJ]	1,99E+02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
NRSF	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
FW	[m^3]	1,21E+00	1,22E-02	7,31E-03	0,00E+00	0,00E+00	1,49E-02	3,55E-03	1,63E-03	-3,66E-01
Caption	PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non renewable primary energy excluding non renewable primary energy resources used as raw materials; PENRM = Use of non renewable primary energy resources used as raw materials; PENRT = Total use of non renewable primary energy resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non renewable secondary fuels; FW = Net use of fresh water									
	The numbers are declared in scientific notation, e.g. 1.95E+02. This number can also be written as: 1.95*100 or 195, while 1.12E-11 is the same as 1.12*10^-11 or 0.0000000000112.									

WASTE CATEGORIES AND OUTPUT FLOWS PER TONNES										
Parameter	**Unit**	**A1-A3**	**A4**	**A5**	**B1-B7**	**C1**	**C2**	**C3**	**C4**	**D**
HWD	[kg]	2,56E-02	4,83E-04	6,33E-05	0,00E+00	0,00E+00	6,67E-04	3,04E-04	6,81E-06	-3,80E-04
NHWD	[kg]	2,49E+01	6,80E+00	3,39E+01	0,00E+00	0,00E+00	5,10E+00	6,48E-02	9,69E+00	-9,48E-01
RWD	[kg]	1,29E-03	2,37E-05	5,71E-06	0,00E+00	0,00E+00	3,40E-05	4,96E-06	3,02E-07	-1,64E-04
CRU	[kg]	9,20E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
MFR	[kg]	6,70E+01	0,00E+00	1,08E+00	0,00E+00	0,00E+00	0,00E+00	9,60E+02	0,00E+00	0,00E+00
MER	[kg]	1,94E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EEE	[MJ]	0,00E+00	0,00E+00	1,18E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EET	[MJ]	0,00E+00	0,00E+00	4,42E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Caption	HWD = Hazardous waste disposed; NHWD = Non hazardous waste disposed; RWD = Radioactive waste disposed; CRU = Components for re-use; MFR = Materials for recycling; MER = Materials for energy recovery; EEE = Exported electrical energy; EET = Exported thermal energy									
	The numbers are declared in scientific notation, e.g. 1.95E+02. This number can also be written as: 1.95*100 or 195, while 1.12E-11 is the same as 1.12*10^-11 or 0.0000000000112.									

WASTE CATEGORIES AND OUTPUT FLOWS PER TONNES		
Parameter	**Unit**	**At the factory gate**
Biogenic carbon content in product	[kg C]	0,00E+00
Biogenic carbon content in accompanying packagaing	[kg C]	1,11E+00
Note	1 kg biogenic carbon is equivalent to 44/12 kg of CO_2	
	The numbers are declared in scientific notation, e.g. 1.95E+02. This number can also be written as: 1.95*100 or 195, while 1.12E-11 is the same as 1.12*10^-11 or 0.0000000000112.	

LCA Results

RT515 DK-NF BS

ENVIRONMENTAL IMPACTS PER TONNES RT515 DK-NF BS										
Parameter	**Unit**	**A1-A3**	**A4**	**A5**	**B1-B7**	**C1**	**C2**	**C3**	**C4**	**D**
GWP-total	[kg CO_2 eq.]	1,97E+02	5,32E+00	7,62E+00	0,00E+00	0,00E+00	7,41E+00	3,46E+00	5,51E-02	-5,75E+00
GWP-fossil	[kg CO_2 eq.]	1,83E+02	5,32E+00	3,21E+00	0,00E+00	0,00E+00	7,37E+00	3,46E+00	5,49E-02	-5,54E+00
GWP-biogenic	[kg CO_2 eq.]	1,42E+01	4,08E-03	4,38E+00	0,00E+00	0,00E+00	6,67E-03	7,93E-04	1,69E-04	-1,99E-01
GWP-luluc	[kg CO_2 eq.]	6,57E-02	2,49E-03	2,77E-04	0,00E+00	0,00E+00	3,58E-03	3,89E-04	1,08E-05	-7,90E-03
ODP	[kg CFC 11 eq.]	1,86E-05	1,16E-07	1,65E-08	0,00E+00	0,00E+00	1,61E-07	5,50E-08	1,90E-09	-1,03E-07
AP	[mol H+ eq.]	9,13E-01	1,79E-02	3,10E-03	0,00E+00	0,00E+00	2,41E-02	3,21E-02	3,54E-04	-3,86E-02
EP-freshwater	[kg PO4 eq.]	1,84E-02	3,78E-04	6,04E-05	0,00E+00	0,00E+00	5,18E-04	1,07E-04	2,56E-06	-2,27E-03
EP-marine	[kg N eq.]	1,62E-01	6,19E-03	1,28E-03	0,00E+00	0,00E+00	8,28E-03	1,49E-02	1,54E-04	-1,05E-02
EP-terrestrial	[mol N eq.]	1,96E+00	6,54E-02	1,32E-02	0,00E+00	0,00E+00	8,75E-02	1,61E-01	1,66E-03	-1,39E-01
POCP	[kg NMVOC eq.]	6,87E-01	2,78E-02	4,82E-03	0,00E+00	0,00E+00	3,60E-02	4,78E-02	6,58E-04	-3,57E-02
ADPm[1]	[kg Sb eq.]	1,06E-03	1,43E-05	1,57E-06	0,00E+00	0,00E+00	2,37E-05	1,21E-06	5,78E-08	-5,58E-05
ADPf[1]	[MJ]	4,63E+03	7,77E+01	1,07E+01	0,00E+00	0,00E+00	1,05E+02	4,53E+01	1,40E+00	-7,15E+01
WDP[1]	[m3]	1,52E+01	3,71E-01	5,20E-02	0,00E+00	0,00E+00	4,27E-01	9,80E-02	5,03E-03	2,02E-01
Caption	GWP-total = Globale Warming Potential - total; GWP-fossil = Global Warming Potential - fossil fuels; GWP-biogenic = Global Warming Potential - biogenic; GWP-luluc = Global Warming Potential - land use and land use change; ODP = Ozone Depletion; AP = Acidifcation; EP-freshwater = Eutrophication – aquatic freshwater; EP-marine = Eutrophication – aquatic marine; EP-terrestrial = Eutrophication – terrestrial; POCP = Photochemical zone formation; ADPm = Abiotic Depletion Potential – minerals and metals; ADPf = Abiotic Depletion Potential – fossil fuels; WDP = water use									
	The numbers are declared in scientific notation, e.g. 1.95E+02. This number can also be written as: 1.95*100 or 195, while 1.12E-11 is the same as 1.12*10^-11 or 0.0000000000112.									
Disclaimer	[1] The results of this environmental indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.									

ADDITIONAL ENVIRONMENTAL IMPACTS PER TONNES										
Parameter	**Unit**	**A1-A3**	**A4**	**A5**	**B1-B7**	**C1**	**C2**	**C3**	**C4**	**D**
PM	[Disease incidence]	1,63E-05	5,37E-07	6,38E-08	0,00E+00	0,00E+00	5,88E-07	8,94E-07	8,94E-09	-6,48E-07
IRP[2]	[kBq U235 eq.]	3,24E+00	9,81E-02	2,32E-02	0,00E+00	0,00E+00	1,40E-01	2,15E-02	1,33E-03	-6,97E-01
ETP-fw[1]	[CTUe]	4,64E+02	3,73E+01	6,03E+00	0,00E+00	0,00E+00	5,18E+01	2,16E+01	5,89E-01	-3,03E+01
HTP-c[1]	[CTUh]	1,02E-07	2,30E-09	3,72E-10	0,00E+00	0,00E+00	3,35E-09	1,06E-09	1,86E-11	-7,66E-09
HTP-nc[1]	[CTUh]	1,62E-06	5,57E-08	1,07E-08	0,00E+00	0,00E+00	7,37E-08	7,26E-09	2,45E-10	-8,36E-08
SQP[1]	-	8,81E+02	7,87E+01	1,24E+01	0,00E+00	0,00E+00	6,24E+01	3,05E+00	2,88E+00	-1,74E+02
Caption	PM = Particulate Matter emissions; IRP = Ionizing radiation – human health; ETP-fw = Eco toxicity – freshwater; HTP-c = Human toxicity – cancer effects; HTP-nc = Human toxicity – non cancer effects; SQP = Soil Quality (dimensionless)									
	The numbers are declared in scientific notation, e.g. 1.95E+02. This number can also be written as: 1.95*100 or 195, while 1.12E-11 is the same as 1.12*10^-11 or 0.0000000000112.									
Disclaimer	[1] The results of this environmental indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.									
	[2] 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.									

RESOURCE USE PER TONNES										
Parameter	**Unit**	**A1-A3**	**A4**	**A5**	**B1-B7**	**C1**	**C2**	**C3**	**C4**	**D**
PERE	[MJ]	7,70E+02	1,13E+00	2,60E-01	0,00E+00	0,00E+00	1,62E+00	2,57E-01	2,77E-02	-3,94E+01
PERM	[MJ]	3,79E+01	0,00E+00	-3,79E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT	[MJ]	8,08E+02	1,13E+00	-3,77E+01	0,00E+00	0,00E+00	1,62E+00	2,57E-01	2,77E-02	-3,94E+01
PENRE	[MJ]	8,84E+02	7,77E+01	1,07E+01	0,00E+00	0,00E+00	1,05E+02	4,53E+01	1,40E+00	-7,15E+01
PENRM	[MJ]	3,29E+01	0,00E+00	-3,29E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PENRT	[MJ]	9,17E+02	7,77E+01	-2,22E+01	0,00E+00	0,00E+00	1,05E+02	4,53E+01	1,40E+00	-7,15E+01
SM	[kg]	1,59E+02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
RSF	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
NRSF	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
FW	[m^3]	7,92E-01	1,22E-02	7,31E-03	0,00E+00	0,00E+00	1,49E-02	3,55E-03	1,63E-03	-3,66E-01
Caption	PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non renewable primary energy excluding non renewable primary energy resources used as raw materials; PENRM = Use of non renewable primary energy resources used as raw materials; PENRT = Total use of non renewable primary energy resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non renewable secondary fuels; FW = Net use of fresh water									
	The numbers are declared in scientific notation, e.g. 1.95E+02. This number can also be written as: 1.95*100 or 195, while 1.12E-11 is the same as 1.12*10^-11 or 0.0000000000112.									

WASTE CATEGORIES AND OUTPUT FLOWS PER TONNES										
Parameter	**Unit**	**A1-A3**	**A4**	**A5**	**B1-B7**	**C1**	**C2**	**C3**	**C4**	**D**
HWD	[kg]	2,12E-02	4,83E-04	6,33E-05	0,00E+00	0,00E+00	6,67E-04	3,04E-04	6,81E-06	-3,80E-04
NHWD	[kg]	2,70E+01	6,80E+00	3,39E+01	0,00E+00	0,00E+00	5,10E+00	6,48E-02	9,69E+00	-9,48E-01
RWD	[kg]	8,07E-04	2,37E-05	5,71E-06	0,00E+00	0,00E+00	3,40E-05	4,96E-06	3,02E-07	-1,64E-04
CRU	[kg]	9,20E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
MFR	[kg]	6,70E+01	0,00E+00	1,08E+00	0,00E+00	0,00E+00	0,00E+00	9,60E+02	0,00E+00	0,00E+00
MER	[kg]	1,94E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EEE	[MJ]	0,00E+00	0,00E+00	1,18E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EET	[MJ]	0,00E+00	0,00E+00	4,42E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Caption	HWD = Hazardous waste disposed; NHWD = Non hazardous waste disposed; RWD = Radioactive waste disposed; CRU = Components for re-use; MFR = Materials for recycling; MER = Materials for energy recovery; EEE = Exported electrical energy; EET = Exported thermal energy									
	The numbers are declared in scientific notation, e.g. 1.95E+02. This number can also be written as: 1.95*100 or 195, while 1.12E-11 is the same as 1.12*10^-11 or 0.0000000000112.									

WASTE CATEGORIES AND OUTPUT FLOWS PER TONNES		
Parameter	**Unit**	**At the factory gate**
Biogenic carbon content in product	[kg C]	0,00E+00
Biogenic carbon content in accompanying packagaing	[kg C]	1,11E+00
Note	1 kg biogenic carbon is equivalent to 44/12 kg of CO_2	
	The numbers are declared in scientific notation, e.g. 1.95E+02. This number can also be written as: 1.95*100 or 195, while 1.12E-11 is the same as 1.12*10^-11 or 0.0000000000112.	

LCA Results

RT510 DK-NF BS

ENVIRONMENTAL IMPACTS PER TONNES RT510 DK-NF BS										
Parameter	**Unit**	**A1-A3**	**A4**	**A5**	**B1-B7**	**C1**	**C2**	**C3**	**C4**	**D**
GWP-total	[kg CO_2 eq.]	1,86E+02	5,30E+00	7,22E+00	0,00E+00	0,00E+00	7,41E+00	3,46E+00	5,51E-02	-5,71E+00
GWP-fossil	[kg CO_2 eq.]	1,71E+02	5,30E+00	3,21E+00	0,00E+00	0,00E+00	7,37E+00	3,46E+00	5,49E-02	-5,51E+00
GWP-biogenic	[kg CO_2 eq.]	1,45E+01	4,08E-03	3,99E+00	0,00E+00	0,00E+00	6,67E-03	7,93E-04	1,69E-04	-1,96E-01
GWP-luluc	[kg CO_2 eq.]	6,31E-02	2,49E-03	2,70E-04	0,00E+00	0,00E+00	3,58E-03	3,89E-04	1,08E-05	-7,80E-03
ODP	[kg CFC 11 eq.]	2,11E-05	1,16E-07	1,63E-08	0,00E+00	0,00E+00	1,61E-07	5,50E-08	1,90E-09	-1,02E-07
AP	[mol H+ eq.]	8,91E-01	1,79E-02	3,06E-03	0,00E+00	0,00E+00	2,41E-02	3,21E-02	3,54E-04	-3,84E-02
EP-freshwater	[kg PO4 eq.]	1,77E-02	3,77E-04	5,79E-05	0,00E+00	0,00E+00	5,18E-04	1,07E-04	2,56E-06	-2,25E-03
EP-marine	[kg N eq.]	1,56E-01	6,17E-03	1,26E-03	0,00E+00	0,00E+00	8,28E-03	1,49E-02	1,54E-04	-1,04E-02
EP-terrestrial	[mol N eq.]	1,91E+00	6,53E-02	1,30E-02	0,00E+00	0,00E+00	8,75E-02	1,61E-01	1,66E-03	-1,38E-01
POCP	[kg NMVOC eq.]	6,64E-01	2,77E-02	4,77E-03	0,00E+00	0,00E+00	3,60E-02	4,78E-02	6,58E-04	-3,55E-02
ADPm[1]	[kg Sb eq.]	1,03E-03	1,43E-05	1,55E-06	0,00E+00	0,00E+00	2,37E-05	1,21E-06	5,78E-08	-5,56E-05
ADPf[1]	[MJ]	4,98E+03	7,75E+01	1,06E+01	0,00E+00	0,00E+00	1,05E+02	4,53E+01	1,40E+00	-7,09E+01
WDP[1]	[m3]	1,47E+01	3,70E-01	5,11E-02	0,00E+00	0,00E+00	4,27E-01	9,80E-02	5,03E-03	2,07E-01
Caption	GWP-total = Globale Warming Potential - total; GWP-fossil = Global Warming Potential - fossil fuels; GWP-biogenic = Global Warming Potential - biogenic; GWP-luluc = Global Warming Potential - land use and land use change; ODP = Ozone Depletion; AP = Acidifcation; EP-freshwater = Eutrophication – aquatic freshwater; EP-marine = Eutrophication – aquatic marine; EP-terrestrial = Eutrophication – terrestrial; POCP = Photochemical zone formation; ADPm = Abiotic Depletion Potential – minerals and metals; ADPf = Abiotic Depletion Potential – fossil fuels; WDP = water use									
	The numbers are declared in scientific notation, e.g. 1.95E+02. This number can also be written as: 1.95*100 or 195, while 1.12E-11 is the same as 1.12*10^-11 or 0.0000000000112.									
Disclaimer	[1] The results of this environmental indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.									

ADDITIONAL ENVIRONMENTAL IMPACTS PER TONNES										
Parameter	**Unit**	**A1-A3**	**A4**	**A5**	**B1-B7**	**C1**	**C2**	**C3**	**C4**	**D**
PM	[Disease incidence]	1,58E-05	5,36E-07	6,32E-08	0,00E+00	0,00E+00	5,88E-07	8,94E-07	8,94E-09	-6,46E-07
IRP[2]	[kBq U235 eq.]	2,96E+00	9,79E-02	2,20E-02	0,00E+00	0,00E+00	1,40E-01	2,15E-02	1,33E-03	-6,87E-01
ETP-fw[1]	[CTUe]	3,90E+02	3,72E+01	5,98E+00	0,00E+00	0,00E+00	5,18E+01	2,16E+01	5,89E-01	-3,02E+01
HTP-c[1]	[CTUh]	9,98E-08	2,30E-09	3,64E-10	0,00E+00	0,00E+00	3,35E-09	1,06E-09	1,86E-11	-7,64E-09
HTP-nc[1]	[CTUh]	1,56E-06	5,56E-08	1,04E-08	0,00E+00	0,00E+00	7,37E-08	7,26E-09	2,45E-10	-8,30E-08
SQP[1]	-	7,83E+02	7,86E+01	1,24E+01	0,00E+00	0,00E+00	6,24E+01	3,05E+00	2,88E+00	-1,72E+02
Caption	PM = Particulate Matter emissions; IRP = Ionizing radiation – human health; ETP-fw = Eco toxicity – freshwater; HTP-c = Human toxicity – cancer effects; HTP-nc = Human toxicity – non cancer effects; SQP = Soil Quality (dimensionless)									
	The numbers are declared in scientific notation, e.g. 1.95E+02. This number can also be written as: 1.95*100 or 195, while 1.12E-11 is the same as 1.12*10^-11 or 0.0000000000112.									
Disclaimer	[1] The results of this environmental indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.									
	[2] 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.									

RESOURCE USE PER TONNES										
Parameter	**Unit**	**A1-A3**	**A4**	**A5**	**B1-B7**	**C1**	**C2**	**C3**	**C4**	**D**
PERE	[MJ]	7,68E+02	1,13E+00	2,51E-01	0,00E+00	0,00E+00	1,62E+00	2,57E-01	2,77E-02	-3,86E+01
PERM	[MJ]	3,46E+01	0,00E+00	-3,46E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT	[MJ]	8,02E+02	1,13E+00	-3,44E+01	0,00E+00	0,00E+00	1,62E+00	2,57E-01	2,77E-02	-3,86E+01
PENRE	[MJ]	7,28E+02	7,75E+01	1,06E+01	0,00E+00	0,00E+00	1,05E+02	4,53E+01	1,40E+00	-7,09E+01
PENRM	[MJ]	3,29E+01	0,00E+00	-3,29E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PENRT	[MJ]	7,61E+02	7,75E+01	-2,23E+01	0,00E+00	0,00E+00	1,05E+02	4,53E+01	1,40E+00	-7,09E+01
SM	[kg]	1,59E+02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
RSF	[MJ]	4,30E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
NRSF	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
FW	[m^3]	7,47E-01	1,21E-02	7,25E-03	0,00E+00	0,00E+00	1,49E-02	3,55E-03	1,63E-03	-3,65E-01
Caption	PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non renewable primary energy excluding non renewable primary energy resources used as raw materials; PENRM = Use of non renewable primary energy resources used as raw materials; PENRT = Total use of non renewable primary energy resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non renewable secondary fuels; FW = Net use of fresh water									
	The numbers are declared in scientific notation, e.g. 1.95E+02. This number can also be written as: 1.95*100 or 195, while 1.12E-11 is the same as 1.12*10^-11 or 0.0000000000112.									

WASTE CATEGORIES AND OUTPUT FLOWS PER TONNES										
Parameter	**Unit**	**A1-A3**	**A4**	**A5**	**B1-B7**	**C1**	**C2**	**C3**	**C4**	**D**
HWD	[kg]	2,24E-02	4,82E-04	6,26E-05	0,00E+00	0,00E+00	6,67E-04	3,04E-04	6,81E-06	-3,79E-04
NHWD	[kg]	2,21E+01	6,78E+00	3,37E+01	0,00E+00	0,00E+00	5,10E+00	6,48E-02	9,69E+00	-9,44E-01
RWD	[kg]	7,32E-04	2,36E-05	5,41E-06	0,00E+00	0,00E+00	3,40E-05	4,96E-06	3,02E-07	-1,62E-04
CRU	[kg]	9,20E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
MFR	[kg]	6,70E+01	0,00E+00	9,66E-01	0,00E+00	0,00E+00	0,00E+00	9,60E+02	0,00E+00	0,00E+00
MER	[kg]	1,94E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EEE	[MJ]	0,00E+00	0,00E+00	1,14E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EET	[MJ]	0,00E+00	0,00E+00	4,28E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Caption	HWD = Hazardous waste disposed; NHWD = Non hazardous waste disposed; RWD = Radioactive waste disposed; CRU = Components for re-use; MFR = Materials for recycling; MER = Materials for energy recovery; EEE = Exported electrical energy; EET = Exported thermal energy									
	The numbers are declared in scientific notation, e.g. 1.95E+02. This number can also be written as: 1.95*100 or 195, while 1.12E-11 is the same as 1.12*10^-11 or 0.0000000000112.									

WASTE CATEGORIES AND OUTPUT FLOWS PER TONNES		
Parameter	**Unit**	**At the factory gate**
Biogenic carbon content in product	[kg C]	0,00E+00
Biogenic carbon content in accompanying packagaing	[kg C]	1,11E+00
Note	1 kg biogenic carbon is equivalent to 44/12 kg of CO_2	
	The numbers are declared in scientific notation, e.g. 1.95E+02. This number can also be written as: 1.95*100 or 195, while 1.12E-11 is the same as 1.12*10^-11 or 0.0000000000112.	

Additional information

Interpretation

In summary, the firing process in the tunnel kiln (A3) is considered the main contributor to the environmental impact of most products by Randers Tegl A/S. It should, however, be recognized that for certain products, the extraction of raw materials (A1) has a significant contribution due to additives e.g. manganese oxide, titanium dioxide, and iron oxide. The global warming impact (GWP-fossil) notably stems from direct carbon dioxide (CO2) emissions during the firing process utilizing fossil fuels. Concerning global warming from biogenic sources (GWP-biogenic) and land use (GWP-luluc), it can be attributed to product packaging. Ozone depletion (ODP) is mainly due to the extraction of natural gas for process heat, causing emissions of Halon 1211 and -1301. Acidification (AP) is primarily a result of direct sulfur dioxide (SO2) emissions from the tunnel kiln. Eutrophication (EP) impact varies, influenced by LPG consumption, nitrogen oxide (NOx) emissions, and materials like clay and manganese oxide. Photochemical ozone formation (POCP) likewise stems from nitrogen oxide (NOx) emissions from the tunnel kiln, natural gas fractionation to LPG, and clay extraction requiring diesel combustion. Depletion of abiotic resources (ADP) is connected to the consumption of natural gas, LPG, and clay, while water usage is associated with additive production (e.g., barium carbonate, manganese oxide) and process water at the factory.

Technical information on scenarios

Transport to the building site (A4):

Name	Unit	Value
Fuel type	-	diesel
Vehicle type	-	Truck (16-32 ton)
EURO-classification	-	EURO5
Distance	km	50
Capacity utilisation (including empty runs)	%	26.32

Installation of the product in the building (A5):

Name	Unit	Value
Installation loss of declared product	kg	30,0
Packaging for waste treatment	kg	3,5
Direct emissions to air, soil, and water	kg	0

Reference service life (RSL):

Process	Unit	Value
Reference service Life	years	150
Declared product properties	-	Technical specifications
Assumed quality of work	-	Supplier guidelines
Outdoor environment	-	Technical specifications
Indoor environment	-	SBI 2009:1
Usage conditions	-	Technical specifications
Maintenance	-	Internal Guidance Document on TBE PCR for Clay Construction Products (2020)

End of life (C1-C4)

Process	Unit	Value
Collected separately	kg	970
Collected with mixed waste	kg	-
For reuse	kg	-
For recycling	kg	960.3
For energy recovery	kg	-
For final disposal	kg	9.7
Assumptions for scenario development	-	Miljøprojekt nr. 2217 (2022)

Re-use, recovery and recycling potential (D)

Process	Unit	Value
Recycled ballast (Road filling)	kg	960,3
Exported electrical energy	kWh	3,2
Exported thermal energy	MJ	43,7

Indoor air

The EPD does not give information on release of dangerous substances to indoor air because the horizontal standards on the relevant measurements are not available. Read more in EN15804+A1 chapter 7.4.1.

Soil and water

The EPD does not give information on release of dangerous substances to soil and water because the horizontal standards on the relevant measurements are not available. Read more in EN15804+A1 chapter 7.4.2.

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Programme Operator		Danish Technological Institute Buildings & Environment Gregersensvej DK-2630 Taastrup www.teknologisk.dk
LCA tool	**LCA-report author**	Asbjørn Uldbjerg Bundgaard & Jesper Jakobsen
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