ENVIRONMENTAL PRODUCT DECLARATION

as per *ISO 14025* and *EN 15804+A2*

Owner of the Declaration	Tenaris S.A.
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-TEN-20240485-IBD1-EN
Issue date	04.06.2025
Valid to	03.06.2030

Seamless steel tubes

Tenaris S.A.

Institut Bauen und Umwelt e.V.

ECO PLATFORM EPD VERIFIED

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1. General Information

Tenaris S.A.

Programme holder

IBU – Institut Bauen und Umwelt e.V.
Hegelplatz 1
10117 Berlin
Germany

Declaration number

EPD-TEN-20240485-IBD1-EN

This declaration is based on the product category rules:

Structural steels, 01.08.2021
(PCR checked and approved by the SVR)

Issue date

04.06.2025

Valid to

03.06.2030

Dipl.-Ing. Hans Peters
(Chairman of Institut Bauen und Umwelt e.V.)

Florian Pronold
(Managing Director Institut Bauen und Umwelt e.V.)

Seamless steel tubes

Owner of the declaration

Tenaris S.A.
Boulevard Royal 26
L2449 Luxembourg
Luxembourg

Declared product / declared unit

1 ton of seamless steel tube

Scope:

This EPD is based on a declared unit of 1 metric ton of Tenaris seamless steel tubes, **representing the average product manufactured**.
The Life Cycle Assessment is based on data from the following Tenaris production plants:

- Koppel & Ambridge (US)
- Bay City (US)
- Dalmine (IT)
- Siderca (AR)
- Silcotub (RO)
- Tamsa (MX)

Production has been modeled using annual production data in **2022**.
Grouping and averaging of the Inventories has been done based on annual production of finished products.
The owner of the declaration shall be liable for the underlying information and evidence; the IBU shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.

The EPD was created according to the specifications of EN 15804+A2. In the following, the standard will be simplified as *EN 15804*.

Verification

The standard EN 15804 serves as the core PCR
Independent verification of the declaration and data according to ISO 14025:2011
☐ internally ☒ externally

Dr Naeem Adibi,
(Independent verifier)

2. Product

2.1 Product description/Product definition

Tenaris manufactures tubular products for the energy industry and industrial applications. When referring (to) seamless pipes applied to a structural application, for the placing on the market of the product in the European Union/European Free Trade Association (EU/EFTA) (with the exception of Switzerland), the product complies with the requirements coming from EN standards and CE marking. Compliance is directly marked or present in the certification.

2.2 Application

Tenaris's seamless steel tubes and pipes, under the scope of application of this EPD, are mainly used in the following application segments:

Oil and gas:
-- Casing and tubing;
-- Premium Connections;
-- Drill pipes;
-- Oil tools

Line pipe and process:
-- Offshore and onshore Line Pipe;
-- Steel tubes and pipes for hydrocarbon processing, refinery, petrochemical, chemical and LNG (Liquified Natural Gas) plants.

Industrial and mechanical:
-- Precision tubes for mechanical and general engineering applications;
-- High-strength, seamless steel tubes for cranes, civil construction and structural offshore applications;
-- Tubes and pipes for heat-recovery steam generators (HRSG), boilers, waste-to-energy and biomass plants.

Low carbon energies:
-- Line pipes for hydrogen storage and transportation;
-- Line pipes for Carbon Capture & Storage;
-- Casing and tubing for Carbon Capture & Storage;
-- Casing and tubing for Hydrogen Storage;
-- Casing and tubing for geothermal wells.

2.3 Technical Data

This EPD applies to all seamless steel pipes of Tenaris S.A., in different steel grades, dimensions, designs and delivery conditions.

Constructional data

Name	Value	Unit
Density	7850	kg/m^3

Depending on the application / steel grade, density varies in the range of 7500 - 8000 kg/m3

Tenaris production follows the most recognized manufacturing standards such as:

- API Specification 5CT "Casing and Tubing"
- API Specification 5CRA/6CRA
- ISO Specification 11960 "Casing and Tubing"
- API Specification 5L 'Line Pipe'
- ISO 3183
- DNV-OS-F101
- ASTM/ASME A/SA 53-106-179-192-209-210-213-333-334-335
- EN 10216/1/2/3
- EN 10210/1/2/3
- EN 10297/1
- EN 10294/1
- EN 10225/1
- ASTM/ASME A/SA 519

2.4 Delivery status

The products of Tenaris are delivered in the required designs of the customers, with a length of 0.5 m to a maximum of 16 m and an outer diameter of 21.9 mm to 711 mm.

2.5 Base materials/Ancillary materials

The products of Tenaris consist of steel manufactured mainly in Tenaris steel shops using ferrous scrap as the primary raw material. The average recycled content of Tenaris steel bars produced in 2022 was around 79 % calculated according to *ISO14021*, the other relevant components are pig iron, DRI/HBI and ferroalloys. A small percentage of steel bars is purchased from external suppliers. The exact composition of the steel depends on the customer's planned area of application and required steel grade.
Raw materials used for the production are reported as average composition as follows:

- - Steel scrap: 77,5 %
- - Pig iron: 3,8 %
- - Directed Reduced Iron (DRI): 16,4 %
- - Ferroalloys: 2,0 %
- - Other elements: 0,3 %

The overall production process yield, including the steel shop and subsequent stages, is 89 %. Materials not incorporated into the final product are lost as water emissions, air emissions, and waste.
This product/article/at least one partial article contains substances listed in the *candidate list* (date 23 January 2024) exceeding 0.1 percentage by mass: **No**.

This product/article/at least one partial article contains other carcinogenic, mutagenic, reprotoxic (CMR) substances in categories 1A or 1B which are not on the candidate list, exceeding 0.1 percentage by mass: **No (not applicable)**.

Biocide products were added to this construction product or it has been treated with biocide products (this then concerns a treated product as defined by the *(EU) Ordinance on Biocide Products No. 528/2012)*: **No**.

2.6 Manufacture

Steel shop
All Tenaris steel shops are based on EAF(Electric Arc Furnace) technology and
consequently, furnaces are loaded mostly with pre-selected scrap. The charge is complemented by DRI (Direct Reduced Iron), which can be internally produced (as in Siderca (ARG)) or externally purchased and HBI (Hot Briquetted Iron) and pig iron coming from external suppliers. All charged materials are melted by an electric arc using chemical energy coming from natural gas, coal and oxygen.
Once the slag has been removed, the liquid steel at a temperature of around 1650 °C is poured into the ladle, where argon bubbling, the addition of ferroalloys and temperature recovering operations are carried out.
Vacuum degassing for special steels is also performed.
Continuous casting transforms liquid steel into round section solid bars for subsequent rolling.
All production processes in the steel shop are controlled by an integrated system including the furnace power management,

the furnace fumes emission, the addition of ferroalloys to reach the required chemical composition, and the control of the casting parameters until the cut--to--length of the bars.

Mandrel rolling
After passing through a rotary hearth furnace, the bars are transferred to the hot-rolling mill to carry out the piercing process, thickness rolling and diameter sizing. The piercing process transforms the hot bar into a hollow: the bar turns due to the movement of two skewed opposing rollers. As a result of the internal tension generated, a hollow is created in the center of the bar. Lamination takes place to reach final dimensions in terms of length and thickness according to the customer's request.

Heat treatments
To obtain the required mechanical properties, when necessary, heat treatment of normalizing or quenching and tempering are performed.

Finishing for OCTG products
Pipes are finalized in finishing lines performing a combination of non-destructive testing to guarantee high quality of the product. Threading technologies provide API or PREMIUM qualified products.

Finishing for other products
To guarantee the high quality of its material, Tenaris performs a combination of non-destructive tests (ultrasound, flux leakage, Eddy current, and magnetic particle inspections).

Tubes and pipes are then transferred to a shipping warehouse/yard.

Quality Management Systems is certified accordingly to *ISO 9001* standard.

2.7 Environment and health during manufacturing

Tenaris Health, Safety and Environment, and Quality Management systems are designed according to the latest versions of the *ISO 14001, ISO 45001* standards. Today, 86 % of the Tenaris production sites are working under management systems certified according to these standards.
The Dalmine site has an Energy management system certified under *ISO 50001*.

2.8 Product processing/Installation

The use of Tenaris products takes place directly at the installation site as well as in processing plants in the region of the future place of use. Installation is carried out by the customer in accordance with the valid standards and guidelines of the respective place of use.

2.9 Packaging

The majority of Tenaris products are delivered to the customer unpacked.
Plastic protectors can be added at the ends of the pipes to protect them. In the present EPD, a packaging consisting of HDPE protector caps was considered for all pipes and included in the calculations.

Name	Value	Unit
Packaging material	HDPE	-
Packaging recycled content	0	%
Packaging weight per DU	5,538	kg / DU

At the end of its life cycle, the discarded packaging is fully disposed of through landfilling. The removal of the packaging does not involve any energy or material consumption.

2.10 Condition of use

Environmental effects of the use stage are not considered in the scope of this study. During the use of the steel pipe products, no changes in the material quality are to be expected if used as intended. Maintenance and inspection requirements depend on the design of the material as well as its place of use.

2.11 Environment and health during use

During the use of the steel pipe products, no effects on human and animal health and no harmful emissions to air, soil and water are expected.

2.12 Reference service life

Due to the diverse applications, varying stress conditions, and environmental factors affecting seamless steel pipes (oil and gas industry, industrial piping, pressure applications, harsh environments, etc.) a standardized reference service life is not declared. Instead, the lifespan of these pipes is determined by their operational service life, which is contingent upon the specific conditions and service requirements of their intended use.
Description of the influences on the ageing of the product when applied in accordance with the rules of technology.

2.13 Extraordinary effects

Fire
Steel pipes are not flammable. No flammable gases or vapours escape from the pipe.

Fire protection

Name	Value
Building material class	n.a.
Burning droplets	n.a.
Smoke gas development	n.a.

n.a. - not applicable

Water
No negative consequences for the environment are expected under the influence of water (e.g. floods).

Mechanical destruction
Unpredictable mechanical impacts on the declared product have no consequences on the environment due to the plastic deformability of steel.

2.14 Re-use phase

The declared products consist of almost 100 % steel and can therefore either be reused or recycled in the steel industry as a valuable secondary raw material.
Depending on pipe application, the share of product that is dismantled and reused/recycled may vary.
Steel is a permanent material that can be recycled as often as required.

2.15 Disposal

The declared product can be fully used as a recycling raw material.
The waste code according to the *European Waste Catalogue* is: **17 04 05 (iron and steel)**.

2.16 Further information

Further information on the product is available on the website at www.tenaris.com

3. LCA: Calculation rules

3.1 Declared Unit

This environmental product declaration refers to a declared unit of 1 ton of seamless steel tube.

Declared unit and mass reference

Name	Value	Unit
Declared unit	1	t

For the calculation of the declared average, both input and production quantities for the entire calendar year 2022 were considered. The calculated results can thus be considered representative for the entire product portfolio of Tenaris.
A linear correlation of the environmental impacts with the product weight is to be expected. Therefore, the conversion from the declared unit to a specific product is possible using a mass-specific scaling factor.

3.2 System boundary

The life cycle assessment of the average seamless steel tube refers to a cradle-to-gate with options analysis with modules (A1-:A3+A4+C+D). Subsequent life cycle phases are part of the analysis.

Module A1-:A3 | Production stage
The production stage includes the burdens of the production of seamless steel tubes of Tenaris worldwide based on production-weighted averages. Most of the used steel ingots are provided by the integrated steel mill. Thus, the upstream environmental impact of the steel supplied is represented by primary data of the respective production site. 2022 Electricity datasets have been used per each specific country; in detail, residual mix for European countries and countries mix in the American continent.
Thermal energy provision is based on natural gas. Module A1-A3 include the production of the packaging of seamless steel tubes.

Module A4 | Downstream delivery to final customer
This LCA study considered the transportation of the finished product from the plant to a customer. Specific distances have been used for national and international transport with Euro 6 >32 t freight lorry, freight train and GLO container ship.

Module C1 | Deconstruction and demolition
Homogeneous dismantling is assumed as an end--of--life scenario. Associated efforts are negligible, and no environmental impacts from the deconstruction of the products are declared. The specific energy demand for dismantling depends on the application of the seamless steel tubes.

Module C2 | Transport
The transport to the disposal of the material is estimated declaring a 50 km radius to the waste processing and 250 km to recovery.

Module C3 | Waste processing
Product flows that reach Module D for recycling leave the product system in C3 (74% of the product based on World Steel statistics). Environmental impacts resulting from the grinding and sorting of steel scrap are included.

Module C4 | Landfilling
Module C4 declares the environmental impacts incurred by landfilling (26 % of the product).

Module D | Credits and loads beyond system boundaryThe potential for substituting primary steel with a recycling scenario (74 % of the product) is outlined in Module D. The recycled content of the products worldwide is 79 %.

3.3 Estimates and assumptions

All assumptions are verified through detailed documentation and correspond to the best possible representation of reality based on the available data. Regional applicability of the used background data refers to average data under European or American conditions taken from the *Ecoinvent database*.

3.4 Cut-off criteria

All inputs and outputs for which data are available are included in the LCA model. Data gaps are filled with conservative assumptions from average data (when available) or with generic data and are documented accordingly. Only data with a contribution of less than 1 % were cut off. Ignoring such data is justified based on the irrelevance of the expected effect. Processes, materials, or emissions known to make a significant contribution to the environmental effects of the products under examination have not been neglected. All relevant data were collected comprehensively. It is assumed that the data have been completely recorded, and the overall total of ignored input flows do not amount to more than 5 % of total energy and mass flows. Environmental impacts of machines, plants and infrastructure were not included.

3.5 Background data

This study uses generic background data for the evaluation of upstream environmental impacts from Ecoinvent database v3.9.1 and is modelled in SimaPro v9.5. The implemented Ecoinvent background datasets are not more than ten years old (between 2019 and 2023).

3.6 Data quality

The foreground data collected at Tenaris are based on the quantities used and volumes produced annually. All process data were collected by Tenaris during periodic reporting. Data on material and energy use originate from material-specific throughput measurements of various processes as well as from controlling. Data were collected in compliance with *Worldsteel 2022* provisions and were subjected to a supplementary plausibility check using material flow analyses of individual process steps. The technological, geographical and time-related representativeness of the data base was kept in mind when selecting background data. Whenever specific data were missing, either generic datasets or representative average data were used instead. The implemented *Ecoinvent* background datasets are not more than ten years old.

3.7 Period under review

Foreground data were collected in the 2022 production year, and the data are based on the volumes produced on an annual basis.

3.8 Geographic Representativeness

Land or region, in which the declared product system is manufactured, used or handled at the end of the product´s lifespan: Global

3.9 Allocation

No allocation methods are used in the calculation of the casted steel impacts, all the slag is treated as waste and all the production process impacts are associated to the net steel output.

3.10 Comparability

Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to *EN 15804* and the building context, respectively the product-specific characteristics of performance, are taken into account. Whenever specific data were missing, either generic datasets or representative average data were used instead.

4. LCA: Scenarios and additional technical information

Characteristic product properties of biogenic carbon

The declared product does not contain any biogenic carbon.

Information on describing the biogenic carbon content at factory gate

Name	Value	Unit
Biogenic carbon content in product	-	kg C
Biogenic carbon content in accompanying packaging	-	kg C

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

Electricity and Thermal energies in production stage (A1:A3)

Thermal energy provision is based on natural gas in all production sites.

The emission factors for electricity were determined for each site using different approaches: considering the respective national or residual mix, purchased electricity supplies and internal production, The table below summarizes the emission factors for natural gas and electricity, which apply exclusively to energy consumption during the production stage (A1-A3).

Site (Country)	Natural Gas	Electricity	
	GWP-ghg (kg CO_2e/MJ)	GWP-ghg (kg CO_2e/kWh)	
Ambridge (US)	51,1	0,368	▪ Country mix
Bay city (US)	51,1	0,368	▪ Country mix
Koppel (US)	51,1	0,368	▪ Country mix
Calarasi (RO)	55,6	0,267	▪ Residual mix
Zalau (RO)	55,6	0,267	▪ Residual mix
Dalmine (IT)	56,2	0,53	▪ 38% Residual mix ▪ 62% Internal production
Siderca (AR)	55,6	0,471	▪ 78% Supplier mix ▪ 22% Internal production
Tamsa (MX)	56,1	0,443	▪ 6% Country mix ▪ 81% Supplier mix ▪ 13% Renewable energy

Transport to the building site (A4)

This LCA study considered the transportation of the finished product from the plant to a customer. Specific distances have been used for national and international transport with Euro 6 >32 t freight lorry, freight train and GLO container ship.

Name	Value	Unit
Transport distance - Freight lorry	345,78	km
Transport distance - Freight train	212,61	km
Transport distance - container ship	4154,94	km

Installation into the building (A5)

The end-of-life of the packaging materials is not declared in Module A5.

Name	Value	Unit
Discarded packaging (HDPE)	5,538	kg/DU
- To reuse	0	%
- To recycling	0	%
- To landfilling	100	%

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End of life (C1 - C4)

This end--of--life scenario refers to the recycling of the seamless steel tubes as the most likely case after the dismantling of the tubes. The actual proportion of recycling is not quantifiable, as it varies by application and country. Therefore, the end--of--life scenario might have to be adapted to the respective application context.

The end--of--life scenario used in this LCA study is based on the following assumptions, aligned with the specifications published for global steel recovery rate from *World Steel* and OECD. Transportation of wastes is by truck (Euro 6, >32 t).

Name	Value	Unit
Collected separately waste type	1000	kg
Collected as mixed construction waste	-	kg
Reuse	-	kg
Recycling	740	kg
Energy recovery	-	kg
Landfilling	260	kg
Distance to landfill	50	km
Distance to sorting plant (materials for recycling)	250	km

Reuse, recovery and/or recycling potentials (D), relevant scenario information

The potential for substituting primary steel and the associated avoided impact is outlined in Module D.

Name	Value	Unit
Net flow of steel scrap	740	kg
Input net flow of recycled steel scrap	790	kg
Quality ratio	1	-

This scenario accounts for a recycling rate of 74 % and an average recycled content of 79 %, with a production process yield of 0,89.

5. LCA: Results

The following table contains the LCA results for a declared unit of 1 ton of seamless steel tube.
Reported scientific notation, i.e., 1,59E+03, is intended to be read as 1590,0 as well as 7,26E+1 is to be read as 72,6, both referred to the corresponding unit.
Product end-of-life scenario as outlined in paragraph '4. LCA: Scenarios and additional technical information', sub-paragraph 'End of life (C1 - C4)'.

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE OR INDICATOR NOT DECLARED; MNR = MODULE NOT RELEVANT)

Product stage			Construction process stage		Use stage							End of life stage				Benefits and loads beyond the system boundaries
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	X	MND	MND	MND	MNR	MNR	MNR	MND	MND	X	X	X	X	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT according to EN 15804+A2: 1 t ton of seamless steel tube

Parameter	Unit	A1-A3	A4	C1	C2	C3	C4	D
GWP-total	kg CO_2 eq	1.61E+03	7.3E+01	5.88E+00	2.4E+01	1.46E+01	7.06E-01	3.99E+01
GWP-fossil	kg CO_2 eq	1.6E+03	7.29E+01	5.88E+00	2.4E+01	1.46E+01	7.06E-01	3.99E+01
GWP-biogenic	kg CO_2 eq	2.42E+00	9.08E-03	2.29E-04	9.64E-04	3.2E-03	5.23E-05	-4.55E-02
GWP-luluc	kg CO_2 eq	2.03E+00	6.94E-03	2.03E-04	6.93E-04	1.33E-02	2.9E-05	-5.35E-04
ODP	kg CFC11 eq	5.54E+00	1.36E+00	5.49E-02	6.31E-02	1.02E-01	6.41E-03	1.31E-01
AP	mol H^+ eq	3.37E-01	1.47E-03	5.55E-06	5.86E-05	2.68E-04	2.54E-06	-4.35E-03
EP-freshwater	kg P eq	1.5E+00	3.54E-01	2.58E-02	2.27E-02	3.99E-02	2.92E-03	1.66E-02
EP-marine	kg N eq	1.59E+01	3.9E+00	2.83E-01	2.49E-01	4.37E-01	3.19E-02	3.5E-01
EP-terrestrial	mol N eq	5.95E+00	1.08E+00	8.42E-02	9.41E-02	1.3E-01	9.66E-03	1.02E-01
POCP	kg NMVOC eq	8.09E-02	1.17E-06	9.25E-08	3.18E-07	1.68E-07	1.05E-08	6E-08
ADPE	kg Sb eq	3.69E-02	2E-06	2.46E-07	1.41E-06	5.52E-07	2.79E-08	5.77E-04
ADPF	MJ	2.26E+04	9.46E+02	8.3E-01	8.43E+00	4.99E+01	4.09E-01	3.13E+02
WDP	m^3 world eq deprived	2.85E+03	1.21E+00	6.09E-02	2.91E-01	9.01E-01	8.19E-03	-5.75E+00

GWP = Global warming potential; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential of land and water; EP = Eutrophication potential; POCP = Formation potential of tropospheric ozone photochemical oxidants; ADPE = Abiotic depletion potential for non-fossil resources; ADPF = Abiotic depletion potential for fossil resources; WDP = Water (user) deprivation potential)

RESULTS OF THE LCA - INDICATORS TO DESCRIBE RESOURCE USE according to EN 15804+A2: 1 t ton of seamless steel tube

Parameter	Unit	A1-A3	A4	C1	C2	C3	C4	D
PERE	MJ	1.52E+03	5.22E+00	1.73E-01	5.15E-01	7.54E+00	4.3E-02	4.65E+01
PERM	MJ	0	0	0	0	0	0	0
PERT	MJ	1.52E+03	5.22E+00	1.73E-01	5.15E-01	7.54E+00	4.3E-02	4.65E+01
PENRE	MJ	2.63E+04	9.63E+02	1.16E+00	1.27E+01	7.28E+01	6.15E-01	4.86E+02
PENRM	MJ	2.96E+02	0	0	0	0	0	0
PENRT	MJ	2.66E+04	9.63E+02	1.16E+00	1.27E+01	7.28E+01	6.15E-01	4.86E+02
SM	kg	1E+03	0	0	0	0	0	0
RSF	MJ	0	0	0	0	0	0	0
NRSF	MJ	0	0	0	0	0	0	0
FW	m^3	6.74E+01	5.47E-02	2.42E-03	1.06E-02	3.06E-02	3.13E-04	-2.48E-01

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 = Use of net fresh water

RESULTS OF THE LCA – WASTE CATEGORIES AND OUTPUT FLOWS according to EN 15804+A2: 1 t ton of seamless steel tube

Parameter	Unit	A1-A3	A4	C1	C2	C3	C4	D
HWD	kg	1.53E+01	0	0	0	0	0	0
NHWD	kg	3.13E+02	0	0	0	0	2.6E+02	0
RWD	kg	8.51E-04	0	0	0	0	0	0
CRU	kg	3.66E+02	0	0	0	0	0	0

MFR	kg	2.91E+02	0	0	0	7.4E+02	0	0
MER	kg	0	0	0	0	0	0	0
EEE	MJ	0	0	0	0	0	0	0
EET	MJ	0	0	0	0	0	0	0

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

RESULTS OF THE LCA – additional impact categories according to EN 15804+A2-optional: 1 t ton of seamless steel tube

Parameter	Unit	A1-A3	A4	C1	C2	C3	C4	D
PM	Disease incidence	9.28E-05	4.09E-06	1.58E-06	1.98E-06	2.31E-06	1.81E-07	2.68E-06
IR	kBq U235 eq	8.83E+01	5.72E-01	6.92E-03	2.19E-02	2.35E-01	9.59E-04	-2.47E-01
ETP-fw	CTUe	2.85E+05	1.04E+03	2.51E+00	3.33E+01	3.48E+01	3.74E-01	3.38E+03
HTP-c	CTUh	5.84E-06	8.15E-09	4.1E-10	2.04E-09	1.99E-09	1.54E-10	6.48E-06
HTP-nc	CTUh	1.04E-05	3.53E-07	5.83E-09	1.97E-07	4.85E-08	9.47E-10	-3.26E-06
SQP	SQP	1.11E+03	3.97E+00	1.64E-01	1.29E+00	7.19E+00	1.07E+01	1.04E+02

PM = Potential incidence of disease due to PM emissions; IR = Potential Human exposure efficiency relative to U235; ETP-fw = Potential comparative Toxic Unit for ecosystems; HTP-c = Potential comparative Toxic Unit for humans (cancerogenic); HTP-nc = Potential comparative Toxic Unit for humans (not cancerogenic); SQP = Potential soil quality index

The additional and optional impact categories according to EN 15804+A2 are not declared, as not required according to PCR Part A.

Disclaimer 1 – for the indicator 'Potential Human exposure efficiency relative to U235'. 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 or radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, radon and from some construction materials is also not measured by this indicator.

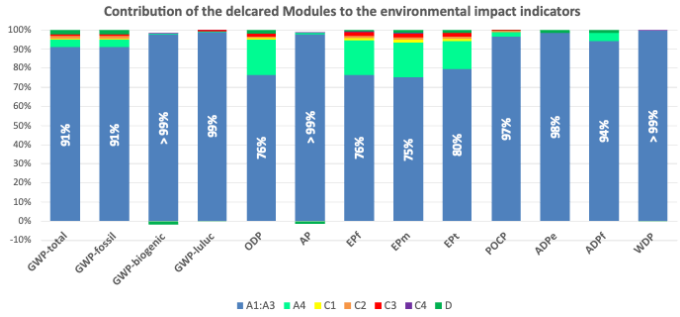
Disclaimer 2 – for the indicators 'abiotic depletion potential for non-fossil resources', 'abiotic depletion potential for fossil resources', 'water (user) deprivation potential, deprivation-weighted water consumption', 'potential comparative toxic unit for ecosystems', 'potential comparative toxic unit for humans – cancerogenic', 'Potential comparative toxic unit for humans - not cancerogenic', 'potential soil quality index'.

The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high as there is limited experience with the indicator.

6. LCA: Interpretation

The following interpretation contains a summary of the LCA results referenced to a declared unit of 1 ton of seamless steel tube weighted average produced worldwide.

In the chart below is reported a comparison of the individual lifecycle phases results. The results show that most of the impacts refer to the production phase (Modules A1-A3).
The environmental effects in the production phase are mainly dominated by the direct process emissions of steel shop production.The environmental impact of the transport of the products to recycling (C2) as well as landfilling of the losses at the end of life (C4) represents a minor contribution to the overall environmental impact of the product.



A linear correlation of the environmental impacts with the product weight is to be expected. Therefore, the conversion from the declared unit to a specific product is possible using a mass -specific scaling factor.

Variability analysis
The variability analysis of key environmental KPIs for the steel industry across the examined products indicates a carbon footprint fluctuation between +27 % and -28 %. Eutrophication and photochemical ozone formation vary from +42 % to -44 %, acidification ranges from +28 % to -7 %, while primary energy indicators (PERT and PENRT) show the highest variation, from +48 % to -51 %.

7. Requisite evidence

Not relevant for this EPD. .

8. References

Standards:

ISO 14001:2015
Environmental management systems — Requirements with guidance for use

ISO 45001:2018
Occupational health and safety management systems — Requirements with guidance for use

ISO 50001:2018 Energy management systems — Requirements with guidance for use

DIN EN ISO 14044:2006-10
Umweltmanagement - Ökobilanz - Anforderun¬gen und Anleitungen (ISO 14044:2006); Deutsche und Englische Fassung EN ISO 14044:2006.

DIN EN ISO 14025:2011
Environmental labels and declarations - Type III environmental declarations - Principles and procedures (ISO 14025:2006); German and English version EN ISO 14025:2011

DIN EN ISO 14040:2006-10
Umweltmanagement - Ökobilanz - Grundsätze und Rahmenbedingungen (EN ISO 14040:2006); Deutsche und Englische Fassung EN ISO 14040:2006

ISO 9001:2015
Quality management systems – Requirements

ISO 3183:2019
Petroleum and natural gas industries — Steel pipe for pipeline transportation systems

EN 10216-1
Seamless steel tubes for pressure purposes - Technical delivery conditions - Part 1:
Nonalloy steel tubes with specified room temperature properties

EN 10216-2:2013+A1:2019
Seamless steel tubes for pressure purposes - Technical delivery conditions - Part 2: Non-alloy and alloy steel tubes with specified elevated temperature properties

EN 10216-4:2013
Seamless steel tubes for pressure purposes - Technical delivery conditions - Part 4: Nonalloy and alloy steel tubes with specified low-temperature properties

ISO 14021:2016
Environmental labels and declarations — Self-declared environmental claims (Type II environmental labelling)

EN 10216-3
Seamless steel tubes for pressure purposes - Technical delivery conditions - Part 3: Alloy fine grain steel tubes

EN 10210-1
Hot Finished Structural Hollow Sections of Non-Alloy and Fine Grain Steels – Part 1: Technical Delivery Conditions

EN 10210-2
Hot Finished Structural Hollow Sections of Non-Alloy and Fine Grain Steels – Part 2: Tolerances, Dimensions, and Sectional Properties

EN 10210-3
Hot Finished Structural Hollow Sections of Non-Alloy and Fine Grain Steels – Part 3: Technical Delivery Conditions for High Strength and Weather-Resistant Steels

EN 10297-1
Seamless Circular Steel Tubes for Mechanical and General Engineering Purposes – Part 1: Technical Delivery Conditions

EN 10294-1
Seamless Steel Hollow Bars for Machining – Part 1: Technical Delivery Conditions

EN 10225-1
Weldable Structural Steels for Fixed Offshore Structures – Part 1: Technical Delivery Conditions

ASTM/ASME A/SA 53
Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

ASTM/ASME A/SA 106
Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service

ASTM/ASME A/SA 179
Standard Specification for Seamless Cold-Drawn Low-Carbon Steel Heat-Exchanger and Condenser Tubes

ASTM/ASME A/SA 192
Standard Specification for Seamless Carbon Steel Boiler Tubes for High-Pressure Service

ASTM/ASME A/SA 209
Standard Specification for Seamless Carbon-Molybdenum Alloy-Steel Boiler and Superheater Tubes

ASTM/ASME A/SA 210
Standard Specification for Seamless Medium-Carbon Steel Boiler and Superheater Tubes

ASTM/ASME A/SA 213
Standard Specification for Seamless Ferritic and Austenitic Alloy-Steel Boiler, Superheater, and Heat-Exchanger Tubes

ASTM/ASME A/SA 333
Standard Specification for Seamless and Welded Steel Pipe for Low-Temperature Service and Other Applications with Required Notch Toughness

ASTM/ASME A/SA 334
Standard Specification for Seamless and Welded Carbon and Alloy-Steel Tubes for Low-Temperature Service

ASTM/ASME A/SA 335
Standard Specification for Seamless Ferritic Alloy-Steel Pipe for High-Temperature Service

Other references:

PCR Part A+A2
Product category rules for building-related products and services. Part A: Calculation rules for life cycle assessment and project report requirements according to EN 15804+A2:2019. version 1.4. Berlin: Institut Bauen und Umwelt e.V.. (ed.), 15.04.2024.

PCR: Part B Structural steels
PCR Guidance-Texts for Building-Related Products and Services, Part B: Requirements on the EPD for Structural steels. Version 8, Berlin: Institut Bauen und Umwelt e.V., 12.07.2023.

API Specification 5CT
Specification for Casing and Tubing

API Specification 5CRA/6CRA
Specification for Casing and Tubing - Corrosion-Resistant Alloys

ISO Specification 11960
Petroleum and Natural Gas Industries – Steel Pipes for Use as Casing or Tubing for Wells

API Specification 5L
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European Chemicals Agency (2024, January 23). https://echa.europa.eu/candidate-list-table

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European Commission (2002). Decision 2000/532/EC.

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World Steel Association, February 14, 2014: A methodology to determine the LCI of steel industry co- products.

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