outokumpu

ENVIRONMENTAL PRODUCT DECLARATION

Cold rolled ferritic stainless steel

EPD of multiple products, based on the average results of the product group

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

Programme:	The International EPD® System, www.environdec.com
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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

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CONTENT OF THE REPORT

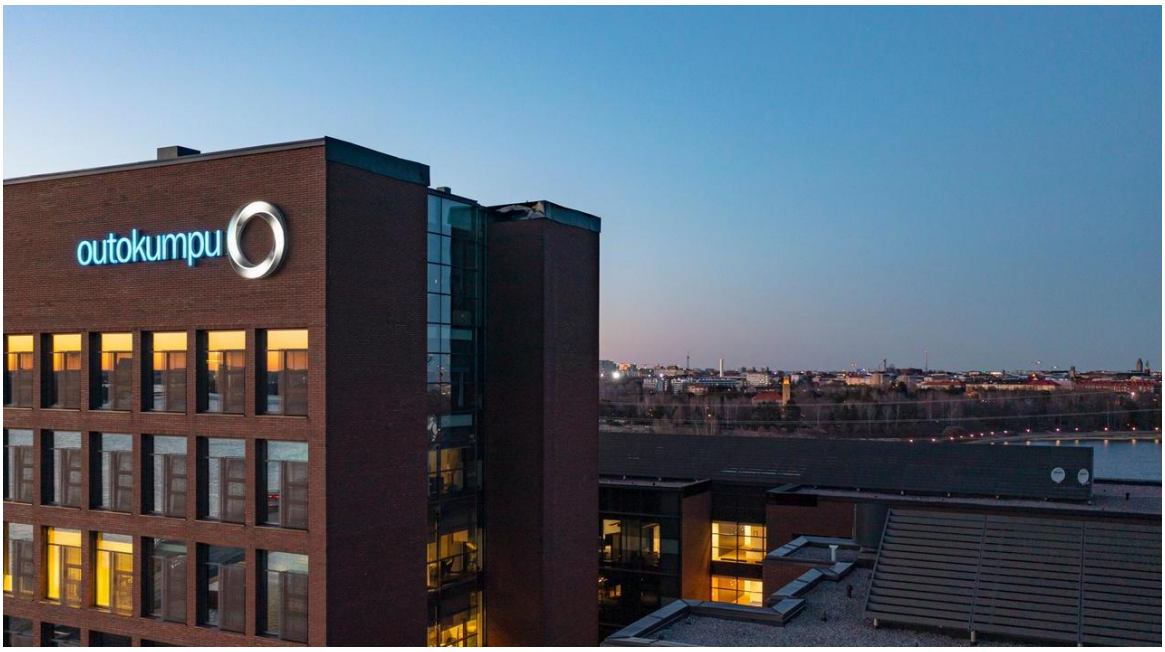

Figure 1 Outokumpu headquarter in Helsinki, Finland

1. Outokumpu Corporation in brief

Outokumpu is accelerating the green transition as the global leader in sustainable stainless steel. Our business is based on the circular economy: our products are made from 95% recycled materials, which we then turn into fully recyclable stainless steel. This steel is utilized in various applications across society, including infrastructure, mobility, and household appliances.

Outokumpu is committed to 1.5°C target to mitigate climate change. With up to 75% lower carbon footprint than the industry average, Outokumpu supports its customers to reduce their emissions. Outokumpu Corporation employs approximately 8,500 professionals in close to 30 countries, with headquarters in Helsinki, Finland and shares listed in Nasdaq Helsinki.

2. Sustainability at Outokumpu

Sustainability at Outokumpu is founded on good governance and on three pillars: environmental, social and governance, all of which need to be in balance. Sustainability is integrated into all our operations, guided by our Code of Conduct and Corporate Responsibility Policy. We expect our business partners and suppliers to follow similar standards. All of our policies are available at outokumpu.com.

2.1. Environment

2.1.1. Environmental certifications

All Outokumpu's production sites are certified according to quality ISO 9001 and environment ISO 14001 management systems, including energy efficiency targets. The functioning of the systems is monitored by both internal and external audits. These management systems are used to implement sustainability issues on the local level.

2.1.2. Climate and emissions

Outokumpu has been a member of the Science Based Targets initiative since 2016. We are committed to limiting global warming to below 1.5°C. By working closely with our customers, we help them to develop solutions that further decrease their carbon footprint and reduce the burden on climate. We are determined to make our operations more energy efficient by maximizing the use of electricity with a low carbon footprint in our operations. In 2023, over 95% of our electricity sources came from low-carbon (renewable and nuclear) sources.

2.1.3. Environmental protection

Protecting the environment in the locations where we operate is our highest priority and a part of our license to operate. In 2023, we also conducted a risk analysis on biodiversity. On the basis of the analysis, we are building site-level roadmaps for actions and further evaluating the supply chain impact on nature.

Figure 2 We produce stainless steel that can be used in various applications

2.2. Social and economic

In terms of social responsibility, human rights are the basis of our business. We respect and protect our people – from Outokumpu's employees to workers in the value chain, customers and local communities.

2.2.1. Impact on society

As a global company we have direct and indirect impacts on local, national and global communities. We are committed to respecting, protecting and promoting the human rights of everyone who may be affected by our activities or through our business relationships.

We contribute to community level well-being by direct and indirect employment, as well as by numerous ways of community involvement. Even though Outokumpu operates in a global market, our production sites are often located in small cities or towns, where we may be one of the few private sector employers in the area. We recognize that our decisions may carry major impacts both our personnel, communities, and the local service providers and suppliers.

At Outokumpu, we value diversity and want to create a work environment that allows all team members to develop and grow. We are operating in an increasingly global environment with a diverse organization. Our ambition towards 2025 is that we aim for our workforce and leadership to represent the societies we operate in and serve.

2.2.2. Safety and employees

We believe that strong safety performance correlates with improved quality and operational efficiency. This way we are also taking responsibility for our people and surrounding societies. Outokumpu aims to be among the industry leaders in safety

with the vision of zero accidents. We focus on building a strong safety culture by establishing common safety principles, sharing good practices and learning from past incidents to create increased awareness.

We see measuring and managing our organizational health in a consistent and comprehensive manner as essential. We are also committed to supporting the development of our people by training programs and performance management.

2.2.3. Supply chain and governance

Outokumpu is a part of a global supply chain by producing stainless steel for leading brands and demanding industries around the globe. Sustainable supply chain management is one of the priorities in our sustainability work at Outokumpu. We support our suppliers towards more sustainable operations and eliminate any environmental or social harm, across the stainless steel value chain, to foster human rights and accelerate the green transition.

Figure 3 Our business is based on circular economy

3. Product information

Table 1. Product information

	Description
Product name:	Cold rolled ferritic stainless steel
Product description:	Ferritic stainless steel grades have good mechanical properties, sitting broadly in the middle between the other stainless steel families. They typically have higher yield strength than austenitic stainless steels. The elongation and forming properties of ferritic steel grades are equivalent to those of high-strength carbon steels
UN CPC code:	4126
Geographical scope:	The declaration applies to cold rolled ferritic stainless steel from the following production sites: - Outokumpu Stainless Oy, Tornio, Finland - Outokumpu Stainless USA LLC, Calvert, AL, USA - Outokumpu Nirosta GmbH, Dillenburg, Germany - Outokumpu Nirosta GmbH, Krefeld, Germany - Outokumpu Mexinox S.A de C.V., San Luis Potosi, Mexico
Technical information:	Density* at 20°C : 7700 kg/m^3 Modulus of elasticity* at 20°C : 220 GPa
Mechanical properties:	Yield Strength $Rp_{0.2}$ MPa: >220 Elongation %: >20
Ferritic grade group included: (EN / ASTM)	EN 1.4016 / 430 EN 1.4509 / 441 EN 1.4510 / XM-8 EN 1.4512 / 409 EN 1.4521 / 444 EN 1.4622 / A240/A240M
Dimensions:	Thickness: 0,3mm – 8mm Width: 20mm – 1532mm

**These properties are influence by various factor for more information refer to EN 10088 for more details or visit Steel Finder | Outokumpu*

4. LCA information

Table 2. Scope and data used in life cycle assessment.

	Description
Functional unit / declared unit:	1 tonne (1 000 kg) of cold rolled ferritic stainless steel at the manufacturer's gate.
Reference service life:	N/A
Time representativeness:	The data is collected from year 2022. The database data used as background data for modelling are published less than ten years ago. Environmental product declarations used as background data for modelling are published less than five years ago.
Database(s) and LCA software used:	SimaPro (release 9.6.0.1) and database Ecoinvent 3.10.
Weighting of data	Weighted average data is used based on site production volumes.
Description of system boundaries:	Cradle to gate with modules C1-C4 and Module D (A1-A3 +C+D) Geographical scope for C1-C4 and D is global.
Cut off criteria:	The cut-off criteria are set to 1 % of renewable and non-renewable primary energy usage and 1 % of the total mass input of that unit process. The total of neglected input flows per module, e.g. per module A1-A3, C1-C4 and module D are a maximum of 5 % of energy usage and mass. The following processes are excluded throughout the life cycle: 1. Processing infrastructure/capital goods 2. For other auxiliary materials either transportation distance was not found, or suitable market process was found.
Key assumptions:	Assumptions were made for the inbound transportation based on the location of the biggest supplier. Based on the global life cycle of stainless steel an assumption is made that 95% of the steel is material recycled and 5% is landfilled
Allocation:	No allocation is made. Steel scrap generated by Outokumpu is fed back directly into the EAF, steel making process as internal scrap. Electricity allocation is based on production volumes.
Electricity modelling:	Electricity mix for European sites: Fossil 4%, Renewable 22% and Nuclear 74% The nuclear and renewable is covered under guarantee of origin. For the Calvert which is in USA generic datasets from Ecoinvent 3.10 was used.

4.1. System diagram

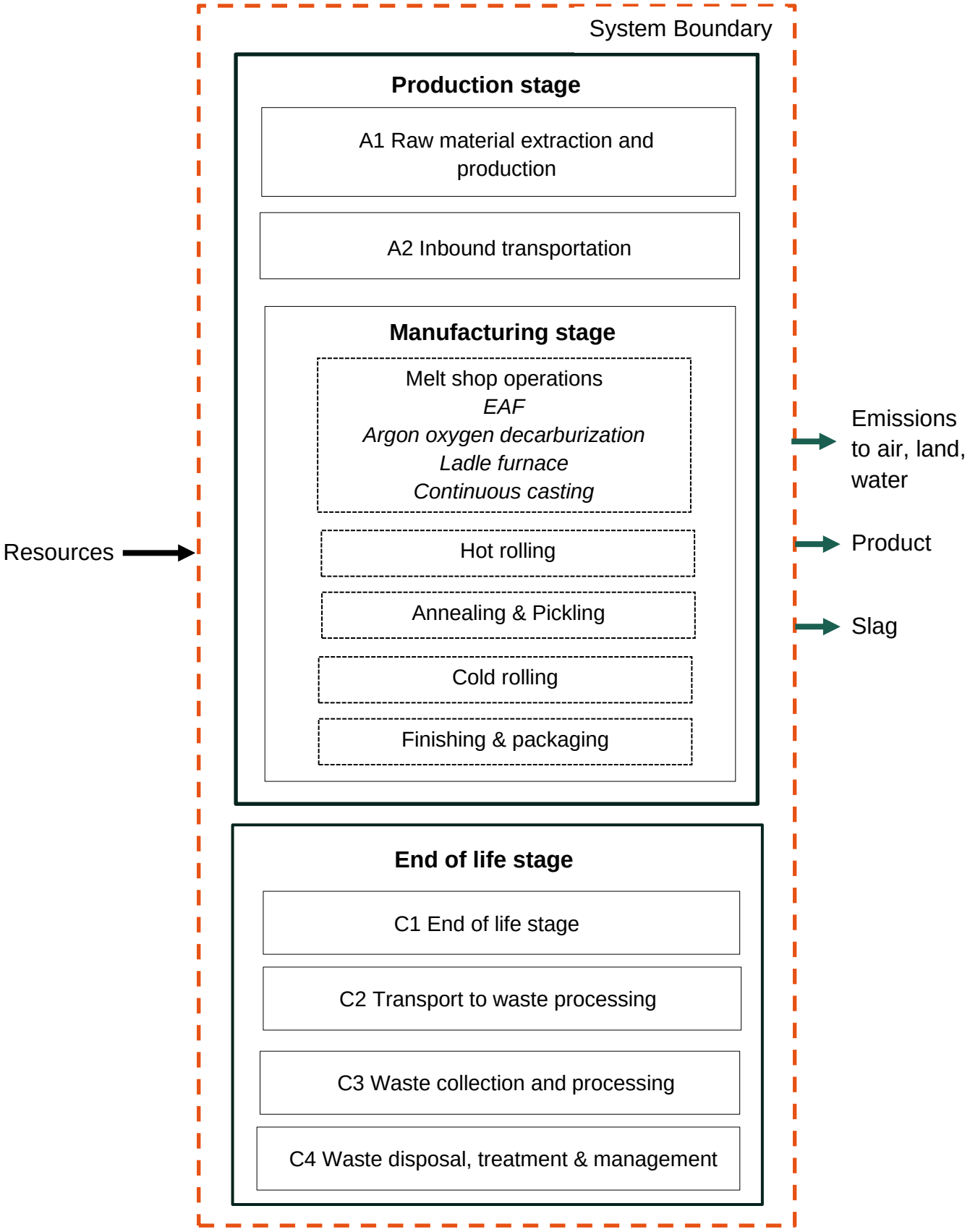

Figure 2. Flow diagram describing the system boundaries.

4.2. Description of manufacturing process

Stainless steels manufacturing process consist of four stages –

1. Melt shop: The melt shop operations are divided into four phases starting with the electric arc furnace where all the scrap, alloying elements and other consumables are added. Followed by the argon oxygen decarburization where the primary goal is to reduce the carbon content of the molten metal while preserving the desired alloying elements. This steps also help removing the impurities. The next step of ladle furnace is important to maintain or adjust the temperature before the continuous casting. Finally, the molten metal is casted in forms of slabs in the continuous casting phase.

2. Hot rolling: In the hot rolling stage the material is mechanically deformed at elevated temperatures to achieve desired shapes and properties. The heated steel enters a series of rollers in a hot rolling mill. The rollers are designed to reduce the thickness and shape the material.

3. Annealing and Pickling: The annealing and pickling is takes place in two phases before cold rolling called the hot annealing and pickling and after the cold rolling called the cold annealing and pickling. Annealing is a heat treatment process used to relieve internal stresses, enhance ductility, and improve the overall mechanical properties of stainless steel while pickling is a surface treatment process designed to remove oxides, scale, and impurities from the stainless steel surface. This step is essential for enhancing the corrosion resistance and surface quality of the steel.

4. Colding rolling and Finishing: Cold rolling involves the reduction of material thickness and enhancement of surface finish at room temperature. The cold rolled material may undergo another set of annealing and pickling to improve the strength and surface finish. In last phase of finishing the product is checked for surface defects, cut to size, polished and packed.

There are various losses in each manufacturing step, and they are accounted as more input added to achieve the desired final product. Most of these losses are used back in the process as internal scrap. Wastewater treatment is included in the manufacturing phase.

Table 3 Climate impact of electricity site wise

Site (Country)	unit	Climate impact
Tornio (Finland)	kg CO_2/KWh	0,042
Calvert (USA)	kg CO_2/KWh	0,464
Krefeld (Germany)	kg CO_2/KWh	0,011
Dillenburg (Germany)	kg CO_2/KWh	0,011
San Luis Potosi, (Mexico)	kg CO_2/KWh	0,622

4.3. Content information

Table 4. Typical composition of ferritic stainless steel

Product components	Interval in %	Post consumer %	Biogenic material, weight-% and kg C/kg
Carbon	0,02% -0,05%		0%
Chromium	11,5% - 21%		0%
Nickel	0,2%		0%
Molybdenum	2 %		0%
Titanium	<0,1%		0%
Niobium	<0,1%		0%
Copper	<0,1%		0%
Scrap	Rest	70%*	0%
TOTAL	100 %		

**Based on company average accordingly to ISO 14021 –*
Impact of post-consumer scrap is calculated according to polluters pay principle

During the life cycle of the product, no hazardous substances included in the "Candidate List for Authorization (SVHC)" have been used in a percentage greater than 0.1% of the weight of the product.

Table 5. Composition of packaging material

Product components	Weight, kg	Weight-% (versus the product)	Weight biogenic carbon, kg C/kg
Plastic	0,400	0,04%	0

Figure 3 Cold rolled coil

4.4. Systems specifications

The scope of the declaration is for 1 tonne of cold rolled ferritic stainless steel from cradle to gate. Table 2 shows modules declared (A1-A3), C1-C4, D and the geographical scope for this life cycle assessment. Modules A4-A5, B1-B7 are not included.

Table 6. Module declaration.

	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	GLO	GLO	GLO	-	-	-	-	-	-	-	-	-	GLO	GLO	GLO	GLO	-
Specific data used	> 40%			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation – products	<10% GWP			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation – sites	< 40% GWP GHG			-	-	-	-	-	-	-	-	-	-	-	-	-	-

**Overall product impact variability is less than 10%*

5. Results of the environmental performance indicators

The scope of the declaration is for 1 tonne of cold rolled ferritic stainless steel from cradle to gate. Results from life cycle assessment are presented in tables 7-11.

5.1. Mandatory impact category indicators according to EN 15804

Table 7. Mandatory impact category indicators

Results per declared unit								
Indicator		**Unit**	**A1-A3**	**C1**	**C2**	**C3**	**C4**	**D**
Global warming potential	**Fossil**	kg CO_2 eq.	1,84E+03	0,00E+00	1,92E+01	2,74E+01	3,13E-01	-1,13E+02
	Biogenic	kg CO_2 eq.	1,85E+01	0,00E+00	5,59E-04	-7,06E-01	4,31E-05	-4,56E-01
	Land use & land use change	kg CO_2 eq.	1,08E+00	0,00E+00	7,78E-03	2,58E-02	1,61E-04	-2,66E-01
Global warming potential – Total		kg CO_2 eq.	1,86E+03	0,00E+00	1,92E+01	2,67E+01	3,13E-01	-1,14E+02
Ozone layer depletion potential		kg CFC 11 eq.	4,79E-02	0,00E+00	2,84E-07	2,92E-07	9,04E-09	-1,29E-06
Acidification potential		mol H^+ eq.	4,13E+00	0,00E+00	4,39E-02	2,92E-01	2,22E-03	-9,77E+00
Eutrophication potential	**Freshwater**	kg P eq.	4,90E-01	0,00E+00	1,52E-03	1,48E-02	2,60E-05	-8,33E-02
	Marine	kg N eq.	8,94E-01	0,00E+00	1,02E-02	6,48E-02	8,44E-04	-1,91E-01
	Terrestrial	mol N eq.	1,11E+01	0,00E+00	1,10E-01	7,30E-01	9,22E-03	-2,09E+00
Photochemical ozone formation		kg NMVOC eq.	3,23E+00	0,00E+00	6,15E-02	2,15E-01	3,30E-03	-1,26E+00
Abiotic depletion potential	**Minerals & metals**	kg Sb eq.	7,85E-03	0,00E+00	6,26E-05	1,60E-03	4,89E-07	-1,21E-02
	Fossil	MJ	1,54E+04	0,00E+00	2,64E+01	1,18E+02	4,74E-01	-8,24E+02
Water deprivation potential		m^3	9,97E+02	0,00E+00	1,22E+00	4,55E+00	3,35E-01	-3,45E+02

** Disclaimer: The results of this environmental impact indicator shall be used with care as the uncertainties of these results are high or as there is limited experience with the indicator.*
Discouraging the use of the results of modules A1-A3 (A1-A5 for services) without considering the results of module C

5.2. Additional mandatory and voluntary impact category indicators

Table 8. Mandatory and voluntary impact category indicators. Human toxicity and ecotoxicity are voluntary impact categories.

The impact contribution of scrap to GWP-GHG results is less than 10%. (Impact calculated according to polluter

Result per declared unit						
Indicator	**Unit**	**A1-A3**	**C1**	**C2**	**C3**	**C4**	**D**
GWP-GHG[1]	kg CO_2 eq.	1,84E+03	0,00E+00	1,92E+01	2,74E+01	3,13E-01	-1,14E+02
Human toxicity Cancer	CTUe	6,88E-05	0,00E+00	2,01E-07	4,14E-07	2,82E-09	-4,95E-06
Human toxicity Non-Cancer	CTUe	1,06E-05	0,00E+00	3,38E-07	2,77E-06	2,62E-09	-1,01E-05
Ecotoxicity, freshwater	CTUe	1,23E+04	0,00E+00	1,45E+02	4,82E+02	2,10E+00	-5,10E+03

[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.

Table 9. Resource use indicators

Results per declared unit								
Indicator		**Unit**	**A1-A3**	**C1**	**C2**	**C3**	**C4**	**D**
Primary energy resources - Renewable	**Used as energy carrier**	MJ	3,49E+02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
	Used as raw material	MJ	3,00E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
	Total	MJ	3,49E+02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Primary energy resources – Non-renewable	**Used as energy carrier**	MJ	7,04E+03	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
	Used as raw material	MJ	1,98E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
	Total	MJ	7,04E+03	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Secondary materials		kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Renewable secondary fuels		MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Non-renewable secondary fuels		MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Net use fresh water		m3	1,78E+02	0,00E+00	2,81E-01	1,39E+00	1,40E-02	1,03E+01

Table 10. Output flow indicators

Results per declared unit							
Indicator	**Unit**	**A1-A3**	**C1**	**C2**	**C3**	**C4**	**D**
Components for re-use	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Material for recycling	kg	8,32E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Materials for energy recovery	kg	1,45E-04	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Exported energy, electricity	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Exported energy, thermal	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00

Table 11. Waste indicators

Results per declared unit							
Indicator	**Unit**	**A1-A3**	**C1**	**C2**	**C3**	**C4**	**D**
Hazardous waste disposed	Kg	2,50E+02	0,00E+00	3,23E-01	1,81E+00	5,67E-03	-4,70E+01
Non-hazardous waste disposed	Kg	2,47E+02	0,00E+00	2,57E+00	1,30E+01	8,28E-02	-7,83E+02
Radioactive waste disposed	kg	9,11E-02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00

6. General information

Accountabilities for PCR, LCA and independent, third-party verification
Product Category Rules (PCR)
CEN standard EN 15804 EF 3.1 serves as the Core Product Category Rules (PCR)
Product Category Rules (PCR): Construction products, 2019:04, version 1.3.4, UN CPC code: 4126
PCR review was conducted by: The Technical Committee on the International EPD ® System. Contact via www.environdec.com info@environdec.com
Life Cycle Assessment (LCA)
LCA accountability: Sayali Bhalekar (Outokumpu, Group sustainability) Outokumpu OYJ
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:** Andrea Paulillo, eloop consulting **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.

7. 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

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

8. Company information

Company information
Outokumpu Oyj
Salmisaarenranta 11 00181 Helsinki Finland
Tel +358 (0) 9 4211 Fax +358 (0) 9 421 5555 Mail sustainability@outokumpu.com Web www.outokumpu.com

Product-related or management system-related certifications
All of Outokumpu's production sites are certified according to quality ISO 9001 and environment ISO 14001 management systems, including energy efficiency targets. The functioning of the systems is monitored by both internal and external audits. These management systems are used to implement sustainability issues on the local level.

9. References

General Programme Instructions of the International EPD® System. Version 4.0.

EN 15804:2012 + A2:2019. Sustainability of construction works – environmental product declarations – core rules for the product category of construction products.

PCR 2019:14. Construction Products, Version 1.3.4.

Outokumpu LCA Report – Outokumpu's stainless steel products, 2024

EN ISO 14040: EN ISO 14040:2009-11 Environmental management - Life cycle assessment - Principles and framework

EN ISO 14044: EN ISO 14044:2006-10 Environmental management – Life cycle assessment – Requirements and guidelines.

EN 10088-2:2024 Stainless steels part 2: Technical delivery conditions for sheets/plates and strip of corrosion resistant steel for general purpose


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