EPD®
ENVIRONMENTAL PRODUCT DECLARATION

NLMK Verona

ENVIRONMENTAL PRODUCT DECLARATION

Steel ingots produced via electric arc furnace in unalloyed and alloyed form

BASED ON
PCR 2015:03 - Basic Iron or steel products & special steels, except construcion steel products - version 2.0
CPC code 4114 and 412
ISO 14025:2010

REGISTRATION NUMBER
S-P-04359

REGISTRATION DATE
2021/08/04

REVISION DATE
2022/10/21 rev. 2

REFERENCE YEAR
2021

VALID UNTIL
2026/08/05

EPD REFERENCES

EPD OWNER: NLMK Verona S.p.A, Via Salieri 22, 37050 Vallese di Oppeano (VR), Italy

PROGRAM OPERATOR: epd international ab, box 21060, SE-100 31 stockholm, sweden; info@environdec.com

INDEPENDENT VERIFICATION

This declaration has been developed referring to the International EPD System, following the General Programme Instructions v 3.01; further information and the document itself are available at: www.environdec.com. EPD document valid within the following geographical area: Italy and other countries worldwide according to sales market conditions.

Reference PCR: 2015:03 - Basic Iron or steel products & special steels, except construcion steel products - version 2.0
PCR review conducted by: The Technical Committee of the International EPD® System - www.environdec.com/TC.
Review chair: Gorka Benito Alonso, IK INGENIERIA, g.benito@ik-ingenieria.com.
The review panel may be contacted via the Secretariat at www.environdec.com/contact.

Independent verification of the declaration and data, according to EN ISO 14025 : 2018

Third party verifier: DNV Business Assurance Italy S.r.l.

☐ EPD process certification (Internal) ☑ EPD verification (External)

Procedure for follow-up during EPD validity involves third party verifier: ☑ YES ☐ NO

Environmental declarations published within the same product category, but from different programmes may not be comparable.
EPD owner has the sole ownership, liability and responsibility of the EPD.

CONTACTS

For inquiries or additional information regarding this EPD and further sustainability activities promoted by NLMK Verona please contact:

Federico Musoni – f.musoni@eu.nlmk.com

Technical support to NLMK S.p.A. was provided by Life Cycle Engineering, Italy. (info@studiolce.it, www.lcengineering.eu).

2022-10-21 Version 2
New verification: Updated background data for ecoinvent 3.8, updated data and results added to EPD. Validation date has been extended by five years

209
ktons
Steel production

363
M€
Turnover

36%
Turnover abroad

298
Employees (2021)

2021 data

ABOUT THE COMPANY

COMPANY PROFILE

NLMK Group is a leading international manufacturer of high-quality steel products with a vertically integrated business model

Mining and steelmaking are concentrated in cost-efficient regions; finished products are manufactured close to our main customers in Russia, North America, and the EU.

Thanks to its self-sufficiency in key raw materials and energy, coupled with the technological superiority of our production capacity, NLMK is one of the most efficient and profitable steelmakers in the world.

NLMK has a diversified product mix, ensuring our leading position in local markets and our sales effectiveness.

By leveraging its advantages – its flexible production chain, balanced product mix, efficient sales system, and widespread customer base – NLMK is able to react quickly to changing market conditions..

PRODUCT INFORMATION

CONTENT DECLARATION

In the table below, components used for the production of steel ingots are reported. The values represent an average composition valid for the two considered families according to alloy element; totals may not match due to roundings

Raw material(*)	Unalloyed ingots	Alloyed ingots
Iron	98%	95%
Nickel	<1%	<1%
Chromium	<1%	3%
Manganese	1%	1%
Other alloy elements	1%	1%

OBJECT OF THIS EPD® IS THE FAMILY OF STEEL INGOTS PRODUCED VIA EAF TECHNOLOGY.
2 DIFFERENT PRODUCTS ARE COVERED IN THIS DOCUMENT:

1
Unalloyed steel ingots

2
Alloyed steel ingots

PRODUCT DESCRIPTION

The declared unit is 1 tonne (1000 kg) of steel ingots produced in NLMK Italian plant located in Verona. With respect to alloying content, the products represent an average from the site. The average consists of different steel qualities with alloying content varying according to the Content declaration reported at page 7. NLMK ingots produced in Verona are available in dimensions between 400-2200 mm, and characterized by close tolerances, excellent straightness as well as roundness, good surfaces and low decarburization. This makes them ideally suited for forging and machining.
Main inputs to the steel making are scrap, alloys, coal, electrodes, fuels, oxygen and other ancillary elements. Scrap is melted in the electric arc furnace, alloyed in the ladle furnace and casted. Steel is then ready for further technological treatments according to customer needs. Major additional processes include waste and slag handling and treatment of water and air.

(*)Recycled material: the recycled steel scrap contents in the unalloyed and alloyed ingots accounts for 50% and 45% respectively. All recycled steel scrap used is assumed to be post-consumer scrap.
Additional iron from primary pig iron is used to obtain the above reported iron shares.

Steel products are considered as articles under the European Regulation (EC) 1907/2006, concerning the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH).

All intentionally added alloying elements in NLMK Verona products with the exception of nickel are not classified as hazardous. Nevertheless, there are certain substances covered by European and national chemical legislation and lists (REACH Annex XIV and XVII, RoHS-directive (2011/65/EC) Annex II and Global Automotive Declarable Substance List ("GADSL")) that cannot physically be measured in steel and others that are difficult to measure due to being present in very low levels.

The alloying elements in NLMK Verona steel are firmly bonded in its chemical matrix. Due to this bonding and to the presence of a protective oxide film the release of any of the constituents is very low and negligible when the steel is used appropriately.

PACKAGING

Distribution packaging: not applicable
Consumer packaging: not applicable

SCOPE AND TYPE OF EPD

GEOGRAPHICAL SCOPE: Global
SOFTWARE: Simapro 9.4.0.2
DATABASE: Ecoinvent 3.8
DECLARED UNIT: 1 tonne of steel ingots at factory gate

THE LCA STUDY INCLUDES ALL THE PROCESSES ACCORDING TO PCR 2015:03

LCA METHODOLOGY

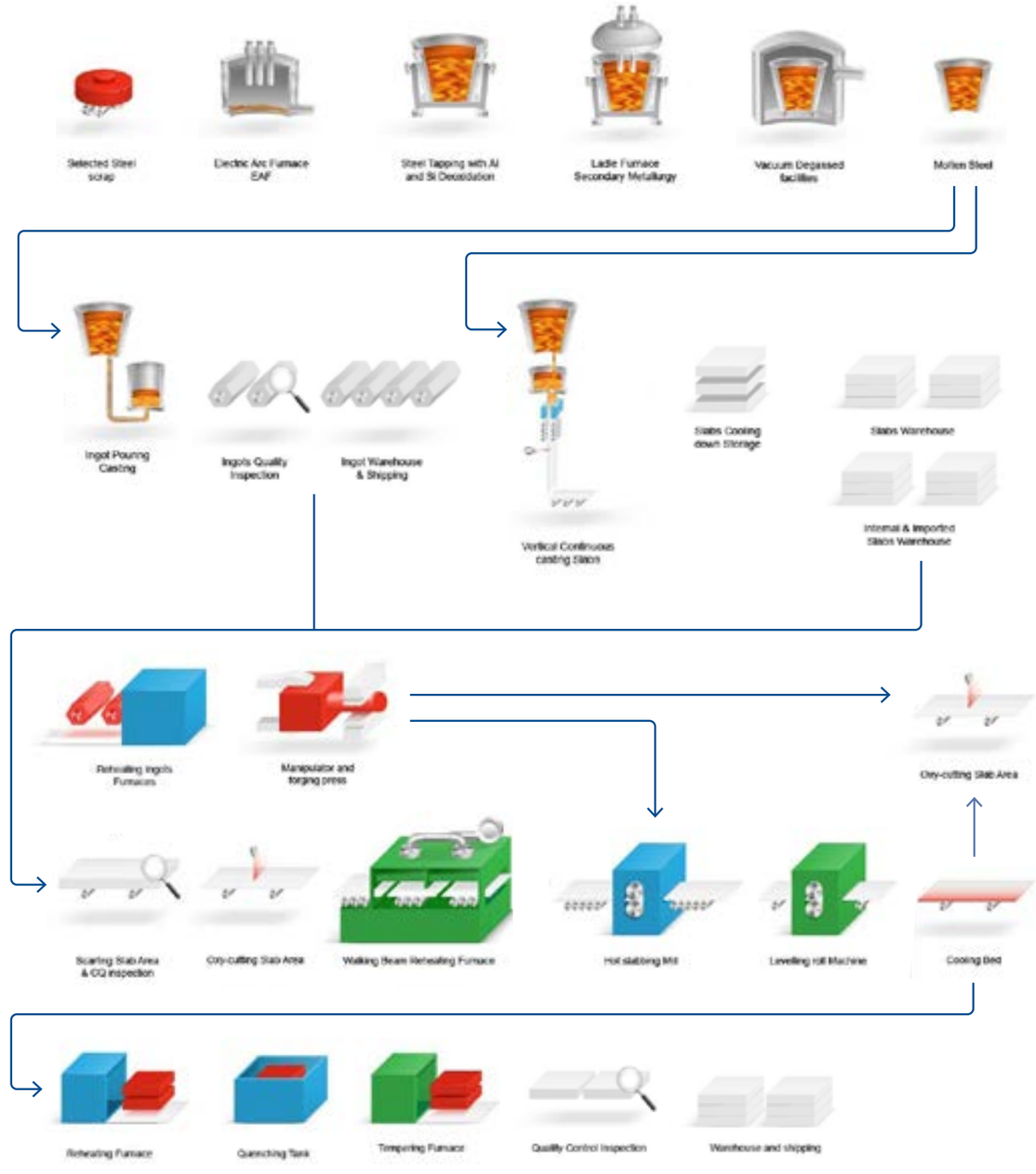
Product environmental burden has been processed in accordance with EPD general instructions issued by International EPD® System (GPI v3.01) and PCR 2015:03 v2.0.

This declaration is a cradle to gate EPD type, based on the application of Life Cycle Assessment (LCA) methodology according to reference PCR.

Steel ingots production is modelled by using specific data from NLMK manufacturing facility located in Verona area, Italy, for year 2021. Customized LCA questionnaires were used to gather in-depth information about all aspects of the production system, in order to provide a complete picture of the environmental burden of the system from scrap and raw mateial supply (Upstream) to steel treatment and energy use (Core).

PRODUCTION PROCESS

NLMK Verona specializes in the production of forged blocks from plastic moulds and is now one of the largest producers on the market. The approach of NLMK Verona is focused on the production and delivery of high-quality steel within a thickness range from 15 mm up to 1200 mm. The production flowchart is reported below. Please note this is the whole production process of NLMK Verona: some parts of the process may not be involved in the manufacturing of products covered by this EPD.



ENVIRONMENTAL PERFORMANCE

The detailed environmental performance (in terms of use of resources, waste generation, potential environmental impacts) is presented for the two phases required by reference PCR:

UPSTREAM PROCESS, CORE PROCESS

According to PCR 2015:03 the values in the Total column are the sum of columns related to Upstream and Core modules

DECLARED UNIT (D.U.)

1 ton of steel ingots at factory gate with variable chemistry and treatments

ENVIRONMENTAL IMPACTS — Unalloyed ingots

PARAMETER		UNIT	UPSTREAM	CORE	TOTAL
Global Warming Potential (GWP)	Fossil	kg CO_2 eq	3.84E+02	5.18E+02	**9.02E+02**
	Biogenic	kg CO_2 eq.	3.55E-01	1.27E-01	**4.81E-01**
	Land use and land trasformation	kg CO_2 eq.	7.02E-01	5.46E-02	**7.56E-01**
	TOTAL	**kg CO_2 eq.**	**3.86E+02**	**5.18E+02**	**9.03E+02**
Acidification Potential (AP)		kg SO_2 eq.	2.55E+00	1.19E+00	**3.73E+00**
Eutrophication Potential (EP)		kg PO_4^3 eq.	1.96E-01	1.08E-01	**3.03E-01**
Photochemical Ozone Creation Potential (POCP)		kg NMVOC eq.	1.39E+00	6.74E-01	**2.06E+00**
Abiotic Depletion Potential - Elements (ADPE)		kg Sb eq.	2.46E-03	9.23E-06	**2.47E-03**
Abiotic Depletion Potential - Fossil Fuels (ADPF)		MJ, net calorific value	5.31E+03	6.76E+03	**1.21E+04**
Water Scarcity Potential (WDP)		m^3 eq	5.84E+01	1.10E+02	**1.69E+02**

USE OF RESOURCES — Unalloyed ingots

PARAMETER		UNIT	UPSTREAM	CORE	TOTAL
Primary Energy Resources (PERE) ***Renewable***	Use as energy carrier	MJ, net calorific vakue	4.61E+02	4.38E+02	**8.99E+02**
	Used as raw materials	MJ, net calorific vakue	0.00E+00	0.00E+00	**0.00E+00**
	TOTAL	**MJ, net calorific vakue**	**4.61E+02**	**4.38E+02**	**8.99E+02**
Primary energy resources (PENRE) ***Not Renewable***	Use as energy carrier	MJ, net calorific vakue	5.76E+03	7.52E+03	**1.33E+04**
	Used as raw materials	MJ, net calorific vakue	0.00E+00	0.00E+00	**0.00E+00**
	TOTAL	**MJ, net calorific vakue**	**5.76E+03**	**7.52E+03**	**1.33E+04**
Secondary Material (SM)		kg	1.06E+03	0.00E+00	**1.06E+03**
Renewable Secondary Fuels (RSF)		MJ, net calorific value	0.00E+00	0.00E+00	**0.00E+00**
Non - Renewable Secondary Fuels (NRSF)		MJ, net calorific value	0.00E+00	0.00E+00	**0.00E+00**
Net Use of Fresh Water (NUFW)		m^3 eq	2.89E+00	2.92E+00	**5.81E+00**

*The trapped carbon in the steel is in such minimal quantity that is not relevant

WASTE PRODUCTION AND OUTPUT FLOWS — Unalloyed ingots

IMPACT CATEGORY	UNIT	UPSTREAM	CORE	TOTAL
Hazardous Waste Disposed (HWD)	kg	0.00E+00	7.34E+00	**7.34E+00**
Non-Hazardous Waste Disposed (NHWD)	kg	0.00E+00	7.40E+01	**7.40E+01**
Radioactive Waste Disposed (RWD)	kg	0.00E+00	0.00E+00	**0.00E+00**
Components for Re-Use (CRU)	kg	0.00E+00	0.00E+00	**0.00E+00**
Material for Recycling (MFR)	kg	0.00E+00	1.37E+02	**1.37E+02**
Materials for Energy Recovery (MER)	kg	0.00E+00	0.00E+00	**0.00E+00**
Exported Energy Electricity (EEE)	MJ	0.00E+00	0.00E+00	**0.00E+00**
Exported Energy Thermal (EET)	MJ	0.00E+00	0.00E+00	**0.00E+00**

ENVIRONMENTAL PERFORMANCE

The detailed environmental performance (in terms of use of resources, waste generation, potential environmental impacts) is presented for the two phases required by reference PCR:

UPSTREAM PROCESS, CORE PROCESS

According to PCR 2015:03 the values in the Total column are the sum of columns related to Upstream and Core modules

DECLARED UNIT (D.U.)

1 ton of steel ingots at factory gate with variable chemistry and treatments

ENVIRONMENTAL IMPACTS — Alloyed ingots

PARAMETER		UNIT	UPSTREAM	CORE	TOTAL
Global Warming Potential (GWP)	Fossil	kg CO_2 eq	4.52E+02	5.18E+02	**9.70E+02**
	Biogenic	kg CO_2 eq.	4.70E-01	1.27E-01	**5.96E-01**
	Land use and land trasformation	kg CO_2 eq.	6.59E-01	5.46E-02	**7.13E-01**
	TOTAL	**kg CO_2 eq.**	**4.53E+02**	**5.18E+02**	**9.71E+02**
Acidification Potential (AP)		kg SO_2 eq.	5.70E+00	1.19E+00	**6.89E+00**
Eutrophication Potential (EP)		kg PO_4^3 eq.	2.69E-01	1.08E-01	**3.77E-01**
Photochemical Ozone Creation Potential (POCP)		kg NMVOC eq.	2.06E+00	6.74E-01	**2.73E+00**
Abiotic Depletion Potential - Elements (ADPE)		kg Sb eq.	1.61E-01	9.23E-06	**1.61E-01**
Abiotic Depletion Potential - Fossil Fuels (ADPF)		MJ, net calorific value	6.15E+03	6.76E+03	**1.29E+04**
Water Scarcity Potential (WDP)		m^3 eq	8.10E+01	1.10E+02	**1.91E+02**

USE OF RESOURCES — Alloyed ingots

PARAMETER		UNIT	UPSTREAM	CORE	TOTAL
Primary Energy Resources (PERE) ***Renewable***	Use as energy carrier	MJ, net calorific vakue	7.89E+02	4.38E+02	**1.23E+03**
	Used as raw materials	MJ, net calorific vakue	0.00E+00	0.00E+00	**0.00E+00**
	TOTAL	**MJ, net calorific vakue**	**7.89E+02**	**4.38E+02**	1.23E+03
Primary energy resources (PENRE) ***Not Renewable***	Use as energy carrier	MJ, net calorific vakue	6.69E+03	7.52E+03	**1.42E+04**
	Used as raw materials	MJ, net calorific vakue	0.00E+00	0.00E+00	**0.00E+00**
	TOTAL	**MJ, net calorific vakue**	**6.69E+03**	**7.52E+03**	1.42E+04
Secondary Material (SM)		kg	1.00E+03	0.00E+00	**1.00E+03**
Renewable Secondary Fuels (RSF)		MJ, net calorific value	0.00E+00	0.00E+00	**0.00E+00**
Non - Renewable Secondary Fuels (NRSF)		MJ, net calorific value	0.00E+00	0.00E+00	**0.00E+00**
Net Use of Fresh Water (NUFW)		m^3 eq	3.28E+00	2.92E+00	**6.19E+00**

*The trapped carbon in the steel is in such minimal quantity that is not relevant

WASTE PRODUCTION AND OUTPUT FLOWS — Alloyed ingots

IMPACT CATEGORY	UNIT	UPSTREAM	CORE	TOTAL
Hazardous Waste Disposed (HWD)	kg	0.00E+00	7.34E+00	**7.34E+00**
Non-Hazardous Waste Disposed (NHWD)	kg	0.00E+00	7.40E+01	**7.40E+01**
Radioactive Waste Disposed (RWD)	kg	0.00E+00	0.00E+00	**0.00E+00**
Components for Re-Use (CRU)	kg	0.00E+00	0.00E+00	**0.00E+00**
Material for Recycling (MFR)	kg	0.00E+00	1.37E+02	**1.37E+02**
Materials for Energy Recovery (MER)	kg	0.00E+00	0.00E+00	**0.00E+00**
Exported Energy Electricity (EEE)	MJ	0.00E+00	0.00E+00	**0.00E+00**
Exported Energy Thermal (EET)	MJ	0.00E+00	0.00E+00	**0.00E+00**

CALCULATION RULES

The environmental burden of the product has been calculated according to GPI v 3.01 and PCR 2015:03 v 2.0.
This declaration is a cradle to gate EPD type, based on the application of Life Cycle Assessment (LCA) methodology to the whole lifecycle system.

In the whole LCA model, infrastructures and production equipments are not taken into account.
Steel ingots were modelled by using specific data from NLMK manufacturing facility (Vallese di Oppeano, VR, Italy) for year 2021.

Customized LCA questionnaires were used to gather indepth information about all aspects of the production system (for example, raw materials contents and specifications, pre treatments, process efficiencies, air and water emissions, waste management), in order to provide a complete picture of the environmental burden of the system.

According to ISO 14040 and 14044, allocation is avoided whenever possible by dividing the system into sub-systems. When allocation cannot be avoided physical properties are used to drive flow analysis.

Data quality has been assessed and validated during data collection process. According to reference PCR the applied cut-off criterion for mass and energy flows is 1% of the gross environmental impact.

SYSTEM BOUNDARIES
UPSTREAM

STEEL SCRAP COLLECTION

RAW MATERIAL TRANSPORTATION TO MANUFACTURING SITE

PRE TREATMENT OF SCRAP INTERNALLY PRODUCED

TREATMENT OF WASTE GENERATED BY UPSTREAM PROCESSES

SYSTEM BOUNDARIES
CORE

SCRAP MELTING IN THE EAF

PROCESS ENERGY, INCLUDING HIGH VOLTAGE GRID ELECTRICITY AND NATURAL GAS

STEEL PRODUCTION AND INGOT CHEMISTRY REFINING

ADDITIONAL ENVIRONMENTAL INFORMATION

1. NLMK Verona plant is equipped with prevention and reduction systems for air emissions, a recirculating loop cooling to minimize water consumption and a waste management plan to prevent and reduce waste generation.

2. EAF primary and secondary dedusting achieve an efficient extraction of all emission sources by using direct off-gas extraction and total building evacuation, with subsequent dedusting by means of a bag filter

3. Prevention and reduction of (PCDD/F) and (PCB) emissions by using the combination of the following techniques:
· use of clean scrap
· appropriate rapid quenching of the EAF off-gas
· final dedusting with a bag filter.

4. Minimization of water consumption by using a recirculating loop cooling system with purge recovery. Removal of solids by sedimentation or filtration, removal of oil with skimming devices.

5. NLMK Verona has a radiation monitoring of scraps and raw materials by means of detection equipment installed at the weighing post. Often, with random criteria, our operators detect the truck of scrap with manual equipment. The scrap is checked during loading into the EAF furnace.
The wastes from the production of steel (dust, slag and millscale) are periodically checked by a spectrometer.

6. NLMK Verona has a closed loop recirculating system for industrial water. Filtering and oil separation allow water reuse, water consumption is therefore limited to evaporation.

7. NLMK Verona is continuously aiming to improve its process and product environmental performance.
The ISO 14001:2015 compliant Environmental Management System main goals are:
- periodic renovation of air and water emission systems
- continuous improvement of installed monitoring systems
- periodic training and communication for the operators on environmental management.

8. NLMK Verona has a steel scrap yard for scraps feeding the EAF. The area is completely paved and covered. Steel scraps are here separated in different classes to allow the most efficient charge bucket preparation.

9. NLMK Verona plant has been implemented a climate strategy with the aim of achieving international goals of current climate change mitigation. The main contribution of industrial activities to climate change (in particular for steel production) is related to CO_2 emissions, wich are being monitored and mitigated in Verona plant. Since 2006, the plant is involved in the application field of 2003/87/CE Directive, so in common trading system of greenhouse gases emission quotes (EU-ETS Emission Trading System), monitoring and sharing greenhouse gases emissions as reported in Regulation UE 2018/2066.

REFERENCES

ISO 14040:2021 and 14044:2021 standards series

ISO 14025:2010

General Programme Instructions for the International EPD® System, version 3.01, 2019-09-18

PCR 2015:03 - Basic Iron or steel products & special steels, except construction steel products, version 2.0, 2020-03-27

Life Cycle Assessment (LCA) applied to steel products manufactured with EAF technology - project report

Impact assessment methods: Version 1.0 of the default list of indicators:
- GWP100, CML 2001 baseline. Version: January 2016.
- AP, CML 2001 non-baseline (fate not included). Version: January 2016.
- EP, CML 2001 baseline (fate not included), Version: January 2016.
- POCP, LOTOS-EUROS as applied in ReCiPe, EN 15804. Version: August 2021.
- ADP elements, CML 2001 baseline. Version: January 2016
- ADP fossil resources, CML 2001 baseline. Version: January 2016
- AWARE method, Characerisation factors (CFs) at country level from WULCA, 2017

NLMK Verona

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