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## ENVIRONMENTAL PRODUCT DECLARATION

according to the standards EN ISO 14025:2010 and EN 15804+A1:2013

Organization	Liberty Ostrava a.s.
Programme holder	CENIA, Czech Environmental Information Agency, executive function of the Agency NPEZ
The document was processed by	Technical and Test Institute for Construction Prague, SOE
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**Reinforcing steel**

## 1. General Information

<b>Liberty Ostrava a.s.</b>	
<b>Program:</b> „National Environmental Labeling Program“- CZ <b>Programme holder:</b> CENIA, Czech Environmental Information Agency, executive function of the Agency NPEZ, Vršovická 1442/65, Praha 10, 100 10, <a href="http://www.cenia.cz">www.cenia.cz</a> ,	<b>Name and address of manufacturer:</b> <b>Liberty Ostrava a.s.,</b> Vratimovská 689/117 719 00 Ostrava-Kunčice
<b>Declaration number:</b> 7210001	<b>Declaration unit:</b> <b>1t of products</b>
<b>Product Category Rules:</b> EN 15804+A1:2013	<b>Product:</b> <b>Reinforcing steel (Ocelová výztuž do betonu)</b>

Liberty Ostrava a.s. through this Environmental product declaration for the type III product. (EPD) expresses its position on environmental issues and demonstrates that it has adequate data on the environmental impacts caused by the production of its products.

Liberty Ostrava a.s. is part of the LIBERTY Steel Group, a global steel and mining company with 30,000 employees in more than 200 locations on six continents. It produces more than 2 million tons of steel a year, which is used mainly in construction and engineering. It is the largest manufacturer of road barriers and pipes in the Czech Republic. In addition to the domestic market, it supplies its products to more than 40 countries around the world.

This EPD provides quantified environmental information on a construction product on a harmonized and scientifically based basis. The aim of this EPD is also to provide basic information about the product in the assessment of the life cycle of buildings and other structures and to help identify those products that are less harmful to the environment.

Regarding the possibility of comparing products in the life cycle assessment of buildings based on their EPD, which is done by determining their contribution to the environmental performance of the building, it is necessary that the EPD of the construction products be processed in accordance with EN 15804 + A1: 2013 *Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products*.

### 1.1. Product data

#### 1.1.1. Product

##### Reinforcing steel

These products are:

Reinforcing steel (rebars, reinforcing steel in coils, special use reinforcement, reinforcement, and shaped connecting rods) and threaded rods cover carbon steel for geotechnical use and concrete reinforcement according to EN10080.

The surface of the reinforcement is patterned to create a better connection especially between the steel bar and the concrete; in addition, the ribbed pattern on the threaded rods, rock pins and connecting rods allows screwing of special connecting elements. EN10080 is not yet a harmonized standard and should be considered as an open standard, i.e. without steel grades. Therefore, the quality of steel can be specified in some national standards, laws, or specifications, as for example listed in the following table 1.



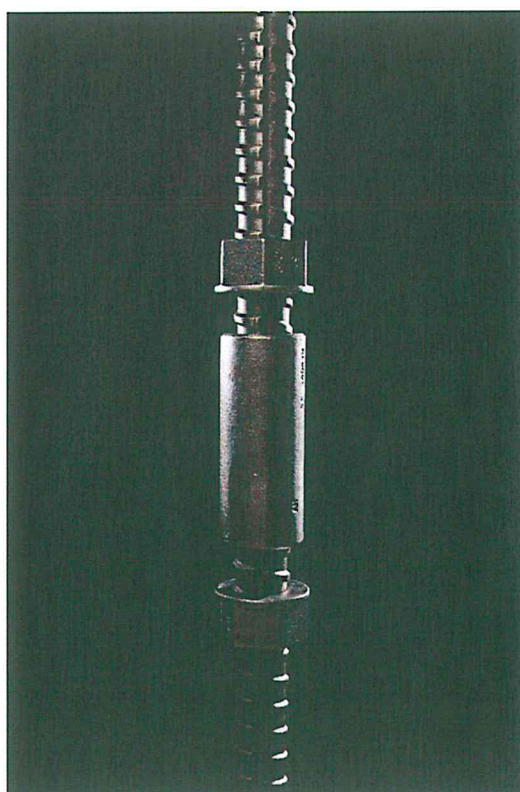
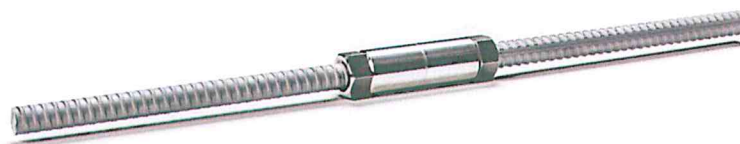
Table 1: Product overview - steel reinforcement for concrete:

Quality class	Diameter [mm]
B500B	8 – 32
B550B	8 – 30
B500SP	8 – 40
B500C	10 – 50
St 450/650, St500/550, St550/620, St555/700, St 670/800, St900/1100	16 - 75

### 1.1.2. Use of the product

Reinforcing steel - designation of solid, mostly round steel bars, which are inserted into the concrete in order to increase its load-bearing capacity and reduce deformations, i.e., the production of reinforced concrete. The condition for the creation of reinforced concrete is the so-called cohesion, which ensures the interaction between the reinforcement and the concrete. The cohesiveness of the circular reinforcements is ensured, among other things, by protrusions which are shaped.

The service life of a reinforced concrete structure is influenced, among other things, by the depth of the reinforcement under the surface, the so-called cover layer, which protects the steel inserts from massive corrosion. To reduce the risk of corrosion, the inserts may be coated or stainless steel inserts may be used.



### 1.1.3. Product specifications

The supplied product may contain many types of alloys depending on the intended performance and properties of the steel product. The declared product data are given in Table 2.

- Design standards: Standards / EN 1993 / apply to the design of steel structures. They include requirements for serviceability, load-bearing capacity, service life and fire resistance of steel structures.
- Technical specifications: EN 10080
- Application standard: EN 1992-1-1, EN 1992-1-2, EN 1992-2, EN 1992-3, ETA 19/0442.

Table 2: Technical data

Parameter	Value	Unit
Tensile strength	500 - 1100	N/mm <sup>2</sup>
Product type	bars and coils	-
Product group	BF	-
Weldability	<0,79	Ceq
Yield strength	450 - 900	N/mm <sup>2</sup>
Elongation	2,5 – 7,5	%
Density	7850	kg/m <sup>3</sup>

The products are subject to mandatory certification and the manufacturer issues the relevant declaration of conformity.

The technical data of the product are declared by the manufacturer in the relevant catalogs of the product line.

### 1.1.4. Rules for use

The products are subject to mandatory certification and the manufacturer issues the relevant declaration of conformity.

#### Environment and health during the use phase

Under normal conditions of use, the products of the rod do not produce any adverse health effects or release volatile organic compounds into the indoor air.

Due to the extremely low release of metal from steel and low maintenance requirements, no environmental impacts are expected on water, air or soil.

### 1.1.5. Method of product delivery

The products are delivered in accordance with the standards listed in chapter 1.1.3.

Product quality is ensured by an effective quality management system according to EN ISO 9001 and in accordance with technical regulations concerning the type of product.

The company has a certified integrated quality management system according to EN ISO 9001, environment according to EN ISO 14001, occupational health and safety according to ČSN ISO 45001 from the certification company BUREAU VERITAS and an energy management system according to EN ISO 50001 from the certification company TÜV NORD Czech, s.r.o.

### 1.1.6. Basic raw materials and auxiliary substances

The basic material of structural steel profiles and trade rods is steel. Alloying elements are added in the form of ferroalloys or metals (the most common elements are manganese, chromium and vanadium). Other elements,

such as nitrogen or copper, may be present in the steel, depending on the designation / quality of the steel. Substances on the list of substances of very high concern subject to authorization by the European Chemicals Agency are not included in declarable quantities in steel.

These basic material components are involved in the production of products:

- Coking coal
- Ore concentrates and ores
- Pellets and iron ore
- Carbonate components (limestone, dolomite)
- Iron scrap
- Refining ingredients (Ferro additives, etc.)
- Aluminum components
- Secondary materials (treated scrap metal waste)

Percentage share of material components per 1 t of product is given in Table 3

Table 3: Percentage share of material components per 1 t of product:

Material component	% by weight per tonne of product
Coking coal	5%
Ore concentrates and aglorudes	52-56%
Pellets and iron ore	cca 5%
Carbonate components	10-13%
Iron scrap	20%
Refining ingredients (Ferro additives, etc.)	1-2%
Aluminum components	< 1%
Secondary materials	< 1%

### 1.1.7. Description of the production process

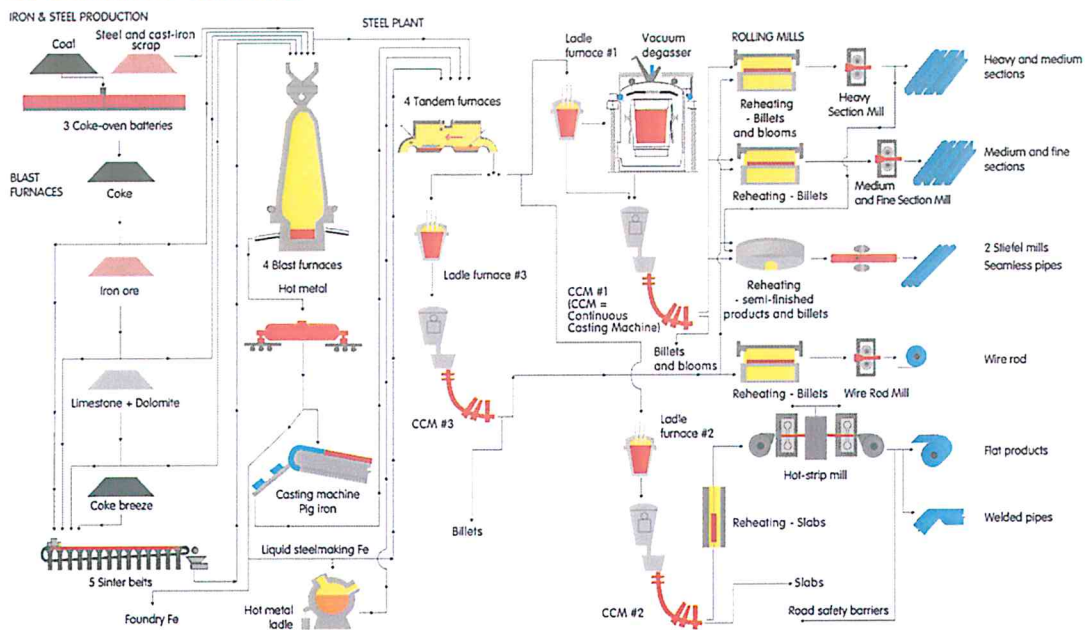
Pig iron is produced in a blast furnace (BF). In integrated steelmaking plants, iron ore is used as a raw material for the preparation of sinter, which is then used in a blast furnace together with coke to produce pig iron. In a basic oxygen furnace (or tandem furnace), various ferroalloys, metal alloys and steel scrap are added to the liquid pig iron. By blowing oxygen, the carbon content in the steel is reduced and thus a liquid steel with the required properties for processing in secondary metallurgy is obtained.

The steel is then cast in a continuous casting machine to obtain semi-finished products such as billets or blocks. The semi-finished products are then hot rolled into bars. At the end of the rolling operation, the reinforcement is divided into the required lengths, usually the reinforcement is tied. In accordance with the requirements for product certification, the products are properly marked with a label.



Fig.1: Scheme of the production process

## Production Flow of LIBERTY Ostrava



### 1.1.8. Waste management

According to the current state of knowledge, there are usually no expected environmental damage during the dismantling and recycling of steel structures.

Thanks to its ability to restore its original properties without loss of quality after melting, it makes steel the most recycled material in the world.

In a built-in environment, 99% of hot-rolled steel profiles can be reused or recycled at the end of their service life. Thanks to the flexibility and adaptability, the functional service life of steel profiles can be extended for renovated and new structures.

Any metal waste is included in group 17.04.05 "Iron and steel".

### 1.2. LCA: Calculation rules

#### 1.2.1. Declared unit

Declared unit is 1t of manufactured products - " Reinforcing steel for concrete".

## 2. Product system and system boundaries

The boundary of the product life cycle study system is only the information module A1 - A3 "Production phase" in accordance with standard EN 15804 + A1: 2013. The created EPD covers the information modules A1-A3, which means from the cradle to the gate. Other modules A4 to C4 and module D, which is intended to provide additional information beyond the life cycle, have not been included in the LCA due to the difficult availability of input data and are not declared for this EPD. The reference service life of the elements is also not declared depending on the unavailability of representative data on operating conditions in the product use stage.

Information on product system boundaries is shown in Table 4.

The boundaries of the system are set to include both those processes that provide material and energy inputs to the system, and subsequent production and transportation processes up to the production gateway, and the processing of all waste resulting from these processes.

The production stage includes these modules:

- **A1**, raw material extraction and processing, processing of secondary material input
- **A2**, transport of raw materials from supplier to manufacturer, in-house transport
- **A3**, manufacturing

including the supply of all materials, products and energy, the treatment of waste until it reaches a state where it ceases to be waste or after the removal of the last material residues during the production stage.

The potential benefits and costs from the production stage do not exceed the selected system boundaries of the A1-A3 system.

Table 4

Information about product system boundaries – information modules (X = included, MND = the module is not declared)																	
Product stage			Construction process stage		Use stage							End of life stage				Supplementary information beyond the building life cycle	
Raw material supply	Transport	manufacturing	Transport	Construction-installation proces	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-, Recovery-, Recyclingpotential	
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D	
X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	X

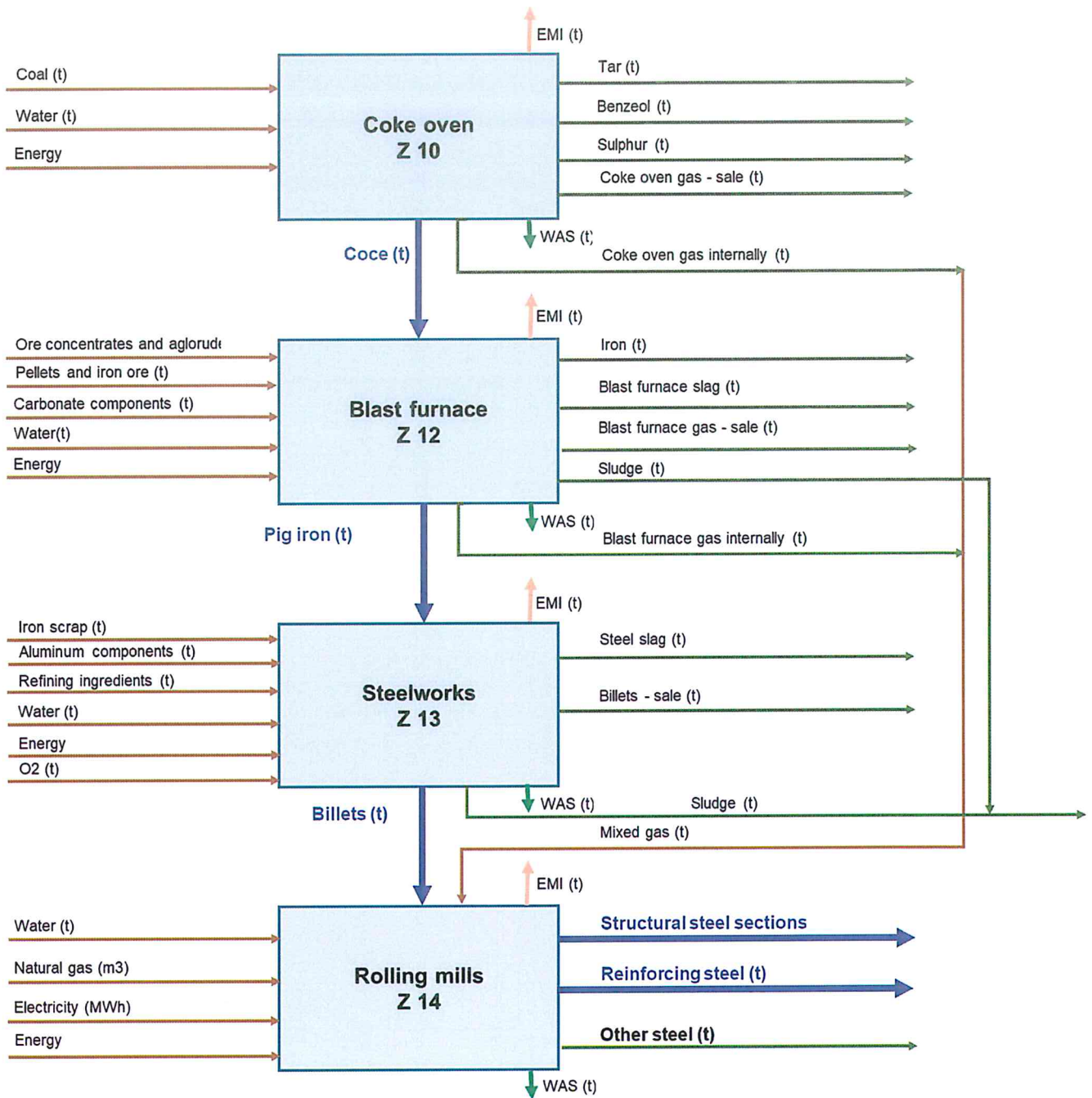
Benefits and costs beyond the system: Module D was additionally quantified from LCI data, which provides information on the benefits beyond the product system from the energy recovery of the waste generated during the production phase of the products and the share of recycled product at end of life..

The boundaries of the product system are considered to include only production processes, not administrative activities.

The production of these products is carried out by these named sub-plants Liberty Ostrava a.s.:

- manufacturing plant 10 – Coke oven,
- manufacturing plant 12 - Blast furnaces,
- manufacturing plant 13 – Steelworks,
- manufacturing plant 14 – Rolling mills.

The processes of these sub-plants are included in the product system boundaries according to the following diagrams:



EMI = Emission  
WAS=Waste

## 2.1. Assumptions and measures taken

The analysis did not include the processes required for the installation of production equipment and the construction of infrastructure. Administrative processes are also not included - inputs and outputs are balanced on the production stage.

As part of this report, some data of auxiliary inputs related to water treatment at WWTPs located in the Liberty Ostrava a.s. area were excluded from the inventory. The exclusion was made on the basis of an unreliable identification of the composition and an unreliable assignment of the corresponding generic data in the calculation program for the environmental impact assessment. The amount of these auxiliary inputs is negligible due to the fixed inputs entering the product.

The time range of the required specific data provided by Liberty Ostrava a.s. for the processing of this report was set as a representative time period of the calendar year 2019. For this period, the organization was provided with all available data for their further processing.



## 2.2. Exclusion rules

All operational data concerning product recipes, energy data, diesel consumption and distribution of annual waste production and emissions according to the records of plants Z10, Z12, Z13 and Z14 were taken for the study. For all considered inputs and outputs, transport costs were considered or differences in transport distances were recognized.

In terms of produced waste, only those wastes that are clearly related to production activities were included in the analysis.

For some input data, due to their complexity of obtaining, alternative methods were chosen in the form of a qualified calculation based on available information. Some input data were converted to units that were needed for the selected generic process data in the environmental impact assessment calculation program.

## 2.3. Sources of environmental data

The necessary specific data concerning the production stage were determined on the basis of the consumed amount of input materials and outputs - production of finished products from the relevant sources of required data. Consumption of quantities of basic raw materials and other inputs was reported on the basis of data from the information system.

All inputs and outputs were entered in system units, namely:

- Material and auxiliary inputs and product outputs in kg
- Sources used as energy input (primary energy) were expressed in kWh or MJ, including renewable energy sources (hydropower, wind energy)
- Water consumption was expressed in m<sup>3</sup> (cubic meters);
- Inputs related to transport were expressed in km (distance), tkm (material transfer) and in kg (diesel consumption, etc.)
- Time was expressed in practical units depending on the scale of assessment: minutes, hours, days, years.

The source of input data was operational data obtained from the organization registered in the SAP information system, as well as outputs from monitoring and measuring waste production and emissions.

They were used for a complete analysis of environmental parameters:

- SimaPro computer software, version 9.01 SimaPro Analyst (Ecoinvent database version 3.6)

## 2.4. Data quality

The data used to calculate the EPD correspond to the following principles:

**Time period:** Manufacturer's data for 2019 are used for specific data (the requirement to use average data for a period of 1 year is met). Data from the Ecoinvent database version 3.6 are used for generic data

**Technological aspect:** Data corresponding to the current production of individual types of products of all plants and corresponding to the current state of technologies used in individual sub-plants Z10, Z12, Z13 and Z14 (product recipes, technological procedures) are used.

**Completeness aspect:** Most of the input data is based on consumption balances, which are accurately recorded in the information system. As part of the completeness check, Liberty Ostrava a.s. and it was checked whether all used inputs / outputs appear in the records (except for the excluded input data listed in Chapter 2. The reliability of the source of specific data is given by the uniformity of the information system collection methodology.

**Geographical aspect:** The generic data used from the Ecoinvent database are used valid for the Czech Republic (i.e. energy inputs) and if data for the Czech Republic are not available, data valid for the EU or according to the supplier's location are used.

**Consistency aspect:** Uniform aspects are used throughout the report (allocation rules, data age, technological scope, time scope, geographical scope).

**Credibility aspect:** All important data were checked for cross-comparison of mass balances.

## 2.5. Assessment period

The data provided by the partial production units of Liberty Ostrava a.s. for the period 2019.

## 2.6. Allocation

As part of the report, the allocation of inputs and output products was made. A uniform method based on weight fractions was used for allocation. The data converted into the declared unit of 1t of produced intermediate products (for production sections Z10, Z12 and Z13) and 1t of produced final products (production section Z14) were considered for the inventory and evaluation.

As part of the data inventory, the entire production process was divided into production sections:

- ☒ Production of one ton of coke inside the factory Z10
- ☒ Production of one ton of pig iron inside the factory Z12
- ☒ Production of one ton of steel billets inside the factory Z13
- ☒ Production of one ton of reinforcing steel inside Z14

For individual production sections, according to input and output flows, the consumption of the number of inputs and the amount of produced outputs (waste, emissions) was allocated according to external sales of co-products (external sales of by-products or energy). Allocation was performed based on mass analysis. To calculate the consumption of sources, the share distribution of types of sources according to the data of OTE, a.s. for 2019.

## 2.7. Comparability

Environmental product declaration from different programs may not be comparable. Comparison or assessment of data reported in the EPD is only possible if all comparable data reported in accordance with EN 15804 + A1: 2013 have been determined according to the same rules.

## 2.8. Product variability

The resulting data are always given for 1 t of the average product.

## 2.9. LCA: Results

Information on environmental impacts is expressed in the following tables. The individual results for the given impact categories are given in Table 5-8. They are related to the declared unit (DJ) - 1t of the product.

The impact assessment was carried out using characterization factors used in the European Life Cycle Reference Database (ELCD) provided by the European Commission - Directorate-General of the Joint Research Center - Institute for Environment and Sustainability.

### 2.9.1. Parameters describing environmental impacts

Table 5 - Parameters describing environmental impacts

Results LCA – Parameters describing environmental impacts (DJ = 1 ton of reinforcing steel)		
Parameter	Unit	A1-A3
Global warming potential (GWP)	kg CO2 ekv.	6,83E+02
Depletion potential of the stratospheric ozone layer (ODP)	kg CFC 11 ekv.	5,41E-05
Acidification potential of soil and water (AP)	kg SO2 ekv.	5,27E+00
Eutrophication potential (EP)	kg (PO4)3- ekv.	2,12E+00
Formation potential of tropospheric ozone (POCP)	kg Ethene ekv.	5,39E-01
Abiotic depletion potential (ADP-elements) for non fossil resources	kg Sb ekv.	5,83E-03
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	MJ, výhřevnost	1,25E+04



## 2.9.2. Parameters describing resource use

Table 6 - Parameters describing resource use

Results LCA – Parameters describing resource use (DJ = 1 ton of reinforcing steel)		
Parameter	Unit	A1-A3
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ	19,1
Use of renewable primary energy resources used as raw materials	MJ	0
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	19,1
Use of non renewable primary energy excluding non renewable primary energy resources used as raw materials	MJ	882
Use of non renewable primary energy resources used as raw materials	MJ	1256
Total use of non renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	2138
Use of secondary material	kg	27,7
Use of renewable secondary fuels	MJ	0
Use of non renewable secondary fuels	MJ	4,88E-1
Net use of fresh water	m <sup>3</sup>	1,57

## 2.9.3. Other environmental information describing different waste categories and output flows

Table 7 - Other environmental information describing waste categories

Results LCA – Other environmental information describing waste categories (DJ = 1 ton of reinforcing steel)			
Parameter	Unit	A1-A3	D
Hazardous waste disposed	kg	4,59E-04	0,00E+00
Non hazardous waste disposed	kg	7,18E-03	0,00E+00
Radioactive waste disposed	kg	0,00E+00	0,00E+00

Table 8 - Other environmental information describing output flows

Results LCA – Other environmental information describing output flows (DJ = 1 ton of reinforcing steel)			
Parameter	Unit	A1-A3	D
Components for re-use	kg	0,00E+00	0,00E+00
Materials for recycling	kg	0,00E+00	9,90E+02
Materials for energy recovery	kg	3,56E-04	0,00E+00
Exported energy	MJ per energy carrier	0,00E+00	5,96E-06

## 2.9.4. LCA: Interpretation

The impact of production on the environment is mainly influenced by the partial process of iron production in blast furnaces and steel production.

- **Global warming potential (GWP)** – the process of iron and steel production has a decisive influence on its overall value. In terms of individual input components, energy consumption (electricity) and transport in the iron production process.

- **Depletion potential of the stratospheric ozone layer (ODP)** – the process of iron and steel production has a decisive influence on its overall value. In terms of individual input components, energy consumption (electricity) and transport in the iron production process.

- **Eutrophication potential (EP)** – the parameter is most influenced by the production in the steel plant and here especially by the consumption of electricity.
- **Formation potential of tropospheric ozone (POCP)** – the value of the parameter indicator is mainly due to the iron and steel production process. From the point of view of individual input components, transport is important in the process of iron production. To a lesser extent, electricity consumption is applied here. Overall, the effect of several components accumulates here.
- **Acidification potential of soil and water (AP)** – the share of the iron and steel production process is significant. From the point of view of individual input components, especially transport in the process of iron production.
- **Abiotic depletion potential (ADP-elements and ADP-fossil fuels)** – consumption of partial components (compressed gas, oxygen, ferroalloys, natural gas, electricity) also plays a significant role here - all especially in the process of steelworks and blast furnaces.

### 3. LCA: scenarios and other technical information

Information modules A4 to C4 were not included in the LCA analysis.

### 4. LCA: Additional information

The EPD does not include additional documentation related to the declaration of supplementary information.

### 5. Reference

ČSN ISO 14025:2010 Environmental labels and declarations - Type III environmental declarations - Principles and procedures

EN 15804+A1:2013 Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products

ČSN EN ISO 14040:2006 (Environmental management - Life Cycle Assessment - Principles and Framework

ČSN EN ISO 14044:2006 Environmental management - Life Cycle Assessment – Requirements and guidelines

ČSN ISO 14063:2007 Environmental management - Environmental communication - Guidelines and examples

ČSN EN 15643-1:2011 Sustainability of construction works - Sustainability assessment of buildings - Part 1: General framework

ČSN EN 15643-2:2011 Sustainability of construction works - Assessment of buildings - Part 2: Framework for the assessment of environmental performance

ČSN EN 15942:2013 Sustainability of construction works - Environmental product declarations - Communication format business-to-business

TNI CEN/TR 15941:2012 Sustainability of construction works - Environmental product declarations - Methodology for selection and use of generic data

ILCD handbook - JRC EU, 2011

Act No. 185/2001 Coll. as amended (Waste Act) - CZ

Decree No. 93/2016 Coll. Waste catalog - Waste catalog - CZ

Regulation No. 1907/2006 of the European Parliament on the Registration, Evaluation, Authorization and Restriction of Chemicals and establishing a European Chemicals Agency - REACH (Registration, Evaluation and Authorization of Chemicals)

Regulation (EC) No 1272/2008 of the European Parliament and of the Council on classification, labeling and packaging of substances and mixtures, amending and repealing Directives 67/548 / EEC and 1999/45 / EC and amending Regulation (EC) No 1907/2006 (CLP Regulation)



SimaPro LCA Package, Pré Consultants, the Netherlands , [www.pre-sustainability.com](http://www.pre-sustainability.com)

Ecoinvent Centre, [www.Ecoinvent.org](http://www.Ecoinvent.org)

Explanatory documents are available from the employee in the job position "Quality Management of Rolling Mills" of the organization Liberty Ostrava a.s.



## 6. Verification EPD

Independent verification of the declaration and data according to ČSN ISO 14025:2010			
CEN standard EN 15804+A1 serves as the core PCR			
<input type="checkbox"/>	internal	<input checked="" type="checkbox"/>	external
<b>Third party verifier <sup>b</sup>:</b>			
Elektrotechnický zkušební ústav, s.p. Pod Lisem 129 171 02 Praha 8 – Troja Česká republika  		Mgr. Miroslav Sedláček <i>Head of the Certification Body</i>  	
Elektrotechnický zkušební ústav, s.p., the Certification Body No. 3018 accredited by Czech Accreditation Institute, o.p.s. according to ČSN EN ISO/IEC 17065:2013			
<sup>a</sup> Products category rules			
<sup>b</sup> Optional for business-to-business communication, mandatory for business-to-consumer communication (see ISO 14025:2006, 9.4).			

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