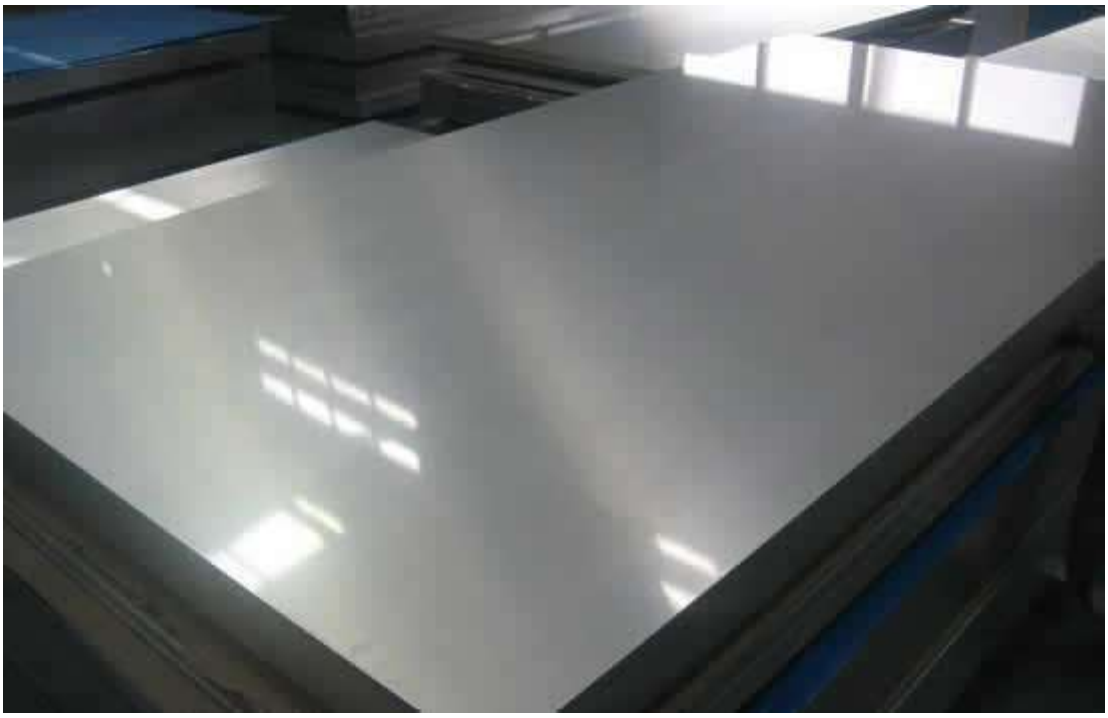
五矿营口中板有限责任公司
MINMETALS YINGKOU MEDIUM PLATE CO., LTD



# Environmental Product Declaration

## Minmetals Yingkou Medium Plate Co. Ltd.

# Steel Plate

五矿营口中板有限责任公司
MINMETALS YINGKOU MEDIUM PLATE CO., LTD

ASTM INTERNATIONAL

# 1. General Information

**Name of the Manufacturer:** Minmetals Yingkou Medium Plate Co. Ltd.

**Program Operator:** ASTM International

**Declaration Number:** EPD 078

**Reference PCR:** IBU PCR Part A: Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Project report – Version 1.3 (19.06.2014). & IBU PCR Part B: Requirements on the EPD for Structural steels – Version 1 (11.04.2013).

**Date of Issuance:** February 1, 2018

**End of Validity:** February 1, 2023

**Product Name:** Steel Plate

**EPD Owner:** Minmetals Yingkou Medium Plate Co. Ltd.
Yejin Street Fanrong Road No. 1
Laobian,Yingkou, Liaoning, China

**Product Group:** Structural Steels

**Declared Product/Declared Unit:** 1 ton steel plate

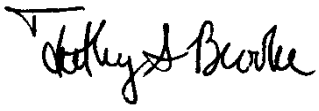
**EPD Scope:** Cradle-to-gate A1, A2, and A3

**Verification:**

The CEN Norm EN 15804 serves as the core PCR. Independent verification of the declaration according to ISO 14025 and ISO 21930.

☐ internal ☒ external

**LCA Reviewer and EPD Verifier:**
Name: Timothy S. Brooke
Organization: ASTM International

Signature: 

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# 2. Product

### 2.1 Product Description

The declared unit is 1 metric ton steel plate – as Manufactured at Minmetal Yingkou Medium Plate Co. Ltd.'s facility. Product specifications for the steel plate product line is available at: http://www.wkyg.com/en/pro_86.jsp

The product group is representative of the entire range of steel plate products produced at the facility. This includes the following grades of products: Q235GJB/C/D/E, Q345GJB/C/D/E, Q390GJC/D/E, Q420GJC/D/E, Q460GJC/D/E, A572 Gr.42, A572 Gr.50, A572 Gr.55, A572 Gr.60, A572 Gr.65, A573 Gr.58/65/70, A633 Gr.A/C/D, A633 Gr.E, SN400A/B, SN400C, SN490B, SN490C, Q195, Q215A/B, Q235A/B/C/D, Q275A/B/C/D, A36, A283 Gr.A/B/C/D, S235JR/J0, S235J2, S275JR/J0, S275J2, S275N/NL, S275M/ML, SS330, SS400, SS490, SM400A/B, SM400C, 0870, 20Mn65Mn, XG05, 08A1.

The products are manufactured in accordance with the following standards:

**Japanese Industrial Standards:**

- G3101 Structural Carbon Steel Plate Specification
- G3106 Hot Rolled for Welded Structure SM490B Steel
- G3136 SN490C Standard hot rolled steel plates

**Chinese National Standards:**

- GB/T 3274 Hot-rolled plates and strips of carbon structural steels and high strength low alloy structural steels
- GB/T 19879 Steel plate for building structure

**ASTM International Standards:**

- A36/A36M Standard Specification for Carbon Structural Steel
- A283/A283M Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates
- A572/A572M Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
- A573/A573M Standard Specification for Structural Carbon Steel Plates of Improved Toughness
- A633/A633M Standard Specification for Normalized High-Strength Low-Alloy Structural Steel Plates

**European Standards:**

- EN 10025-2 Hot rolled products of structural steels
- EN 10025-3 Hot rolled products of structural steels. Technical delivery conditions for normalized/normalized rolled weldable fine grain structural steels
- EN 10025-4 Hot rolled products of structural steels. Technical delivery conditions for thermomechanical rolled weldable fine grain structural steels

### 2.2 Application:

Steel plate is used in a variety of structural applications. Various grades, thicknesses, and dimensions are specified according to engineering requirements specific to the application.

### 2.3 Technical Data:

**Table 1: Technical Information**

| Name | Value | Unit |
|---|---|---|
| Density | Approx. 7850 | kg/m3 |
| Strength and other technical properties vary and are available from the manufacturer for specific orders | | |

### 2.4 Delivery Status:

The declared unit is 1 ton steel plate. The product is available in different dimensions and thicknesses.

### 2.5 Base Materials:

The steel plate product is 100% steel. Steel is is an iron alloy that also contains small amounts of carbon and other base metals. For the purposes of toxicity screening, steel is considered a base ingredient with CAS # 12597-69-2.

### 2.6 Manufacturing:

The processes that occur at Minmetals Yingkou Medium Plate Co's facility include: sintering, blast furnace, basic oxygen furnace, billet production, and the rolling of the finished plate product.

### 2.7 Environment and Health Considerations during Manufacturing:

Minmetals Yingkou Medium Plate Co. has obtained certificates for both its Environmental Management System (http://www.wkyg.com/en/list_info_97_261.jsp) and its Occupational Health and Safety Management System (http://www.wkyg.com/en/list_info_97_260.jsp).

### 2.8 Product Processing/Installation:

The product is installed in a manner and with equipment that is specific to the application for which it was purchased.

**2.9 Packaging:**
Steel plate is considered a bulk product and is not customarily packaged for shipment. The product is secured to transport vehicles using reusable straps. Any packaging that is required by a particular customer is negotiated separately from the materials contract and is thus outside the system boundary.No packaging was included in the product system.

**2.10 Conditions of Use:**
No special features of contents are required for the period of use.

**2.11 Environment and Health Considerations During Use**:
Steel plates are comprised of inert materials and poses no signficant environmental or health considerations during the use phase.

**2.12 Reference Service Life:**
No reference service life is declared in this EPD as the scope is limited to A1-A3.

**2.13 Extraordinary Effects:**
The product has been tested according to Chinese national standard: GB 8624 Fire Test to Building Material and Products.

**2.14 Re-use Phase:**
At the end of the product's service life, steel plates may be reused or recycled, however, neither of these are included in this EPD. No energy recovery possibilities exist.

**2.15 Disposal:**
The waste code in accordance with the European Waste Index is 17 04 05. At the end of service life the product may either be re-used, disposed in a landfill, or recycled.

**2.16 Further Information:**
No further information is reported in this EPD.

**2.17 Content Declaration Regarding Potential Toxicity**
This EPD makes no claim as to the potential toxicity of the product during use. As noted in Section 2.5, the product is 100% steel which is considered a base ingredient with CAS # 12597-69-2. No known health risks are associated the use of steel plate.

# 3: LCA Calculation Rules

### 3.1 Declared Unit:

The declared unit is 1 ton steel plate produced by Minmetals Yingkou Medium Plate Co. Ltd.

### 3.2 System Boundary:

The system boundary for this study is limited to a cradle-to-gate focus. The following three life cycle stages as per the governing PCR are included in the study scope:

- A1- Raw material supply (upstream processes): extraction, handling, and processing of the iron ore, coke, limestone, and other material inputs.
- A2- Transportation: transportation of all input materials and fuels from the suppliers to the gate of the manufacturing facility.
- A3- Manufacturing (core process): the processes that occur at Minmetals Yingkou Medium Plate's facility: sintering, blast furnace, basic oxygen furnace, billet production, and the rolling of the finished plate product. Also includes the operations of the manufacturing facility and all process emissions that occur at the production facility.

### 3.3 Estimates and Assumptions:

All significant foreground data was gathered from the manufacturer based on measured values (i.e. without estimation). The weighted average product profile is assumed to be representative of the various dimensions and options offered by Minmetals Yingkou Medium Plate Co.'s product offerings.

### 3.4 Cut-off Criteria:

The cut-off criteria for all activity stage flows considered within the system boundary conform with ISO14044:2006, section 6 of the IBU PCR Part A:

- All inputs and outputs to a (unit) process were included in the calculation for which data is available. Data gaps were filled by conservative assumptions with average or generic data. Any assumptions for such choices were documented;
- In case of insufficient input data or data gaps for a unit process, the cut-off criteria were 1% of renewable and non-renewable primary energy usage and 1% of the total mass of that unit process. The total neglected input flows, e.g. per module A1-A3 were a maximum of 5% of energy usage and mass. Conservative assumptions in combination with plausibility considerations and expert judgement were used to demonstrate compliance with these criteria;
- Particular care was taken to include material and energy flows known to have the potential to cause significant emissions into air and water or soil related to the environmental indicators of this standard. Conservative assumptions in combination with plausibility considerations and expert judgement were be used to demonstrate compliance with these criteria.

### 3.5 Background Data and 3.6 Data Quality:

Data was gathered for the primary material inputs used in the production of the steel plate for calendar year 2016. Table 2 describe each LCI data source for raw materials (A1), transportation by mode (A2) and the core manufacture process (A3). Table 2 also includes a data quality assessment for all secondary data on the basis of the technological, temporal, and geographical representativeness as per the IBU PCR.

**Table 2: Secondary Data Sources and Data Quality Assessment**

**A1: Raw Material Inputs**

| Inputs | LCI Data Source | Geography | Year | Data Quality Assessment |
|---|---|---|---|---|
| **Iron Ore** | ecoinvent 3: Iron ore, crude ore, 46% Fe {GLO}\| market for \| Alloc Def, U | Global | 2013 | **Technology:** very good<br>Process models average global technology<br>**Time:** very good<br>Data is <5 years old<br>**Geography:** very good<br>Data is representative of global conditions. |
| **Limestone** | ecoinvent 3: Limestone, crushed, washed {GLO}\| market for \| Alloc Def, U | Global | 2011 | **Technology:** very good<br>Process models average global technology<br>**Time:** good<br>Data is 6 years old<br>**Geography:** very good<br>Data is representative of global conditions. |
| **Bentonite** | ecoinvent 3: Bentonite {GLO}\| market for \| Alloc Def, U | Global | 2011 | **Technology:** very good<br>Process models average global technology<br>**Time:** good<br>Data is 6 years old<br>**Geography:** very good<br>Data is representative of global conditions. |
| **Coke** | ecoinvent 3: Coke {GLO}\| market for \| Alloc Def, U | Global | 2011 | **Technology:** very good<br>Process models average global technology<br>**Time:** good<br>Data is 6 years old<br>**Geography:** very good<br>Data is representative of global conditions. |
| **Dolomite** | ecoinvent 3: Dolomite {GLO}\| market for \| Alloc Def, U | Global | 2011 | **Technology:** very good<br>Process models average global technology<br>**Time:** good<br>Data is 6 years old<br>**Geography:** very good<br>Data is representative of global conditions. |

| **A2: Transportation** | | | | |
|---|---|---|---|---|
| **Inputs** | **LCI Data Source** | **Geography** | **Year** | **Data Quality Assessment** |
| **Trucking** | ecoinvent 3: Transport, freight, lorry >32 metric ton, EURO3 {GLO}\| market for \| Alloc Def, U | Global | 2011 | **Technology:** very good<br>Process models average global technology<br>**Time:** good<br>Data is 6 years old<br>**Geography:** very good<br>Data is representative of global conditions. |
| **Ocean Transport** | ecoinvent 3: Transport, freight, sea, transoceanic ship {GLO}\| market for \| Alloc Def, U | Global | 2011 | **Technology:** very good<br>Process models average global technology<br>**Time:** good<br>Data is 6 years old<br>**Geography:** very good<br>Data is representative of global conditions. |
| **A3: Manufacturing** | | | | |
| **Energy** | **LCI Data Source** | **Geography** | **Year** | **Data Quality Assessment** |
| **Electricity** | ecoinvent 3: Electricity, high voltage {CN}\| market for \| Alloc Def, U | China | 2013 | **Technology**: very good<br>Process models average Chinese technology<br>**Time**: very good<br>Data is less than 5 years old<br>**Geography**: very good<br>Data is representative of Chinese electricity. |
| **Natural Gas** | ecoinvent 3: Heat, central or small-scale, natural gas {RoW}\| market for heat, central or small-scale, natural gas \| Alloc Def, U | Global | 2011 | **Technology:** very good<br>Process models average global technology<br>**Time:** good<br>Data is 6 years old<br>**Geography:** very good<br>Data is representative of global conditions. |
| **Liquid Propane** | ecoinvent 3: Propane, burned in building machine {GLO}\| propane, burned in building machine \| Alloc Def, U | Global | 2011 | **Technology:** very good<br>Process models average global technology<br>**Time:** good<br>Data is 6 years old<br>**Geography:** very good<br>Data is representative of global conditions. |
| **Water** | **LCI Data Source** | **Geography** | **Year** | **Data Quality Assessment** |
| **Municipal Water** | Modeled as elementary flow | N/A | N/A | N/A |
| **Waste** | **LCI Data Source** | **Geography** | **Year** | **Data Quality Assessment** |
| **Steel scrap recycled** | Internally recycled | N/A | N/A | N/A |

**3.7 Period under Review:**
Data was gathered for the primary material inputs used in the production of the steel plate for calendar year 2016.

**3.8 Allocation:**
Minmetals Yingkou Medium Plate Co. produces several valuable coproducts from the five unit processes that were included in the scope of the study. The IBU PCR requires economic allocation but, in this case, the overall value of the various coproducts was less than 5% of total revenue. Thus, in accordance with the PCR's principle of making conservative estimations, we did not allocate any of the environmental burden to the coproducts and instead allocated 100% to the primary product output. As per the PCR, all the loads from granulation, drainage and transportation of blast furnace slag are attributed to 100% to the granulated blast furnace slag.

Recycling processes were treated as closed loop recycling because the scrap is recycled in the same facility. No credits were given to the product system for the value of the recyclable materials and the burden to recycle the scrap was incorporated within the modeled unit processes.

**3.9 Comparability:**

This LCA was created using industry average data for upstream materials. Data variation can result from differences in supplier locations, manufacturing processes, manufacturing efficiency and fuel types used.

# 4: LCA: Scenarios and additional technical information

The scope of this EPD is limited to modules A1-A3 and thus no additional scenario or technical information is applicable.

## 5. LCA: Results

Life cycle impact assessment (LCIA) is the phase in which the set of results of the inventory analysis – the inventory flow table – is further processed and interpreted in terms of environmental impacts and resource use inventory metrics. As specified in the IBU PCR, Table 3 below summmarizes the LCA results for the cradle-to-gate (A1-A3) product system.

**Table 3: LCA Results**
**Description of the System Boundary**
**(x : included in LCA; mnd: module not declared)**

| Product | | | Construction Installation | | Use | | | | | | | End-of-life | | | | Benefits of Loads Beyond the System Boundary | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 |
| A1 | A2 | A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 | D | D | D |
| x | x | x | mnd | mnd | mnd | mnd | mnd | mnd | mnd | mnd | mnd | mnd | mnd | mnd | mnd | mnd | mnd | mnd |

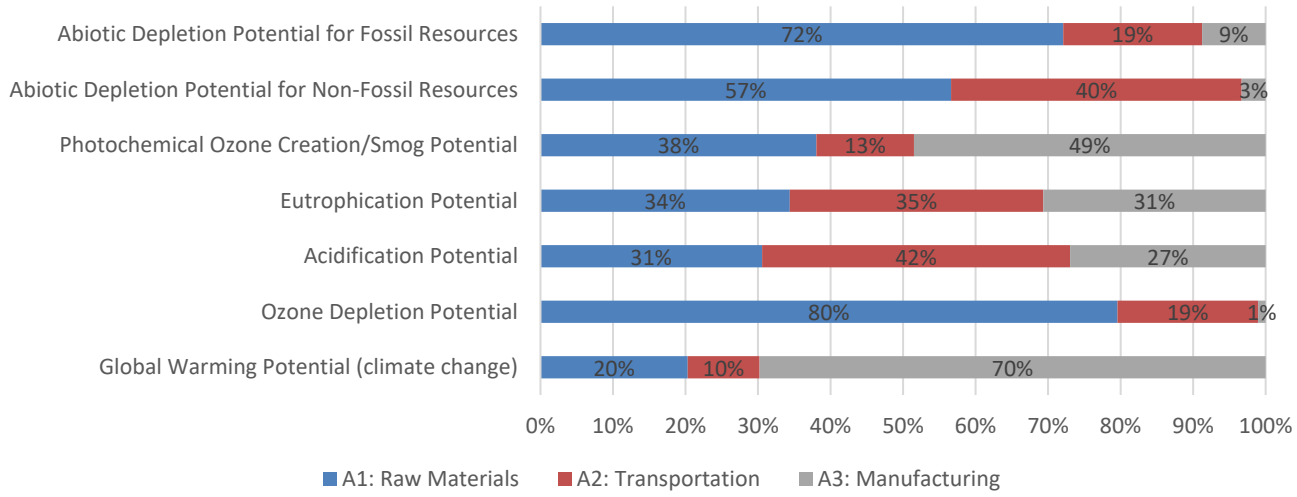
**Table 3 Continued: Impact Assessment Results for 1 ton Steel Plate**

| *LCIA Indicators* | | Unit | A1-A3 Total |
|---|---|---|---|
| **GWP** | Global Warming Potential (climate change) | kg CO2-eq | 2.61E+03 |
| **ODP** | Ozone Depletion Potential | kg CFC-11-eq | 8.48E-05 |
| **AP** | Acidification Potential | kg SO2-eq | 1.13E+01 |
| **EP** | Eutrophication Potential | kg PO4-eq | 1.21E+00 |
| **POCP** | Photochemical Ozone Creation/Smog Potential | kg C2H4 eq | 1.16E+00 |
| **ADPE** | Abiotic Depletion Potential for Non-Fossil Resources | kg Sb eq | 3.64E-04 |
| **ADPF** | Abiotic Depletion Potential for Fossil Resources | MJ Surplus | 1.97E+04 |
| ***Inventory Metrics – Resources*** | | **Unit** | **A1-A3 Total** |
| **PERE** | Use of renewable primary energy as energy | MJ | 1.46E-02 |
| **PERM** | Use of renewable primary energy as a material | MJ | 3.00E+00 |
| **PERT** | Total use of renewable primary energy | MJ | 3.01E+00 |
| **PENRE** | Use of non-renewable primary energy as energy | MJ | 1.89E+04 |
| **PENRM** | Use of non-renewable primary energy as a material | MJ | 3.00E+00 |
| **PENRT** | Total use of non-renewable primary energy | MJ | 1.89E+04 |
| **SM** | Use of secondary materials | kg | 0.00E+00 |
| **RSF** | Use of renewable secondary fuels | MJ | 0.00E+00 |
| **NRSF** | Use of non-renewable secondary fuels | MJ | 0.00E+00 |
| **FW** | Use of freshwater resources | m3 | 3.48E+00 |
| ***Inventory Metrics – Waste and Outputs*** | | **Unit** | **A1-A3 Total** |
| **HWD** | Disposed of Hazardous Waste | kg | 0.00E+00 |
| **NHWD** | Disposed of Non-Hazardous Waste | kg | 0.00E+00 |
| **RWD** | Disposed of Radioactive Waste | kg | 0.00E+00 |
| **CRU** | Components for Reuse | kg | 0.00E+00 |
| **MFR** | Materials for Recycling | kg | 0.00E+00 |
| **MER** | Materials for Energy Recovery | kg | 0.00E+00 |
| **EEE** | Exported Electrical Energy (Waste to Energy) | kg | 0.00E+00 |
| **ETE** | Exported Thermal Energy (Waste to Energy) | kg | 0.00E+00 |

## 6. Interpretation

Figure 1 shows the relative contribution to the cumulative impacts of the A1 through A3 phases of the cradle-to-gate life cycle. The impact categories abiotic depletion potential impact categories are dominated by Module A1. This is due to the fact this module incorporates all the upstream extraction of the primary material inputs to the steel product. Module A2 causes the highest proportion of acidification, eutrophication impacts due to the incomplete combustion of mobile combustion. The manufacturing Module A3 causes the highest proportion of smog and global warming potential due to the conversion of coke and iron inputs into steel, greenhouse gases, and process emissions that occurs at the manufacturing facility.

Figure 1: Contribution of Modules A1, A2, and A3 to Environmental Impact Indicators




## 7. Requisite Evidence

No environemental claims beyond the LCA results are made in this EPD and thus no additional evidence is required.

# 8. References

1. Athena Institute: 2017 - A Cradle-to-Gate Life Cycle Assessment of Steel Plate Manufactured by Minmetals Yingkou Medium Plate Co. Ltd. Background LCA report to this EPD.
2. EN 15804:2012 Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products.
3. IBU PCR Part A: Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Project report – Version 1.3 (19.06.2014).
4. IBU PCR Part B: Requirements on the EPD for Structural steels – Version 1 (11.04.2013).
5. ISO 21930: 2007 Building construction – Sustainability in building construction – Environmental declaration of building products.
6. ISO 14025: 2006 Environmental labeling and declarations - Type III environmental declarations - Principles and procedures.
7. ISO 14044: 2006 Environmental management - Life cycle assessment - Requirements and guidelines.
8. ISO 14040: 2006 Environmental management - Life cycle assessment - Principles and framework.