ENVIRONMENTAL PRODUCT DECLARATION
as per /ISO 14025/ and /EN 15804/

<table>
<thead>
<tr>
<th>Owner of the Declaration</th>
<th>ArcelorMittal Commercial RPS S.à r.l.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Programme holder</td>
<td>Institut Bauen und Umwelt e.V. (IBU)</td>
</tr>
<tr>
<td>Publisher</td>
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<tr>
<td>Declaration number</td>
<td>EPD-ARM-20180069-IBD1-EN</td>
</tr>
<tr>
<td>ECO EPD Ref. No.</td>
<td>ECO-00000787</td>
</tr>
<tr>
<td>Issue date</td>
<td>28/06/2018</td>
</tr>
<tr>
<td>Valid to</td>
<td>27/06/2023</td>
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</table>

EcoSheetPiles™
ArcelorMittal

www.ibu-epd.com / https://epd-online.com
General Information

ArcelorMittal Commercial RPS S.à r.l.

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Declaration number
EPD-ARM-20180069-IBD1-EN

This Declaration is based on the Product Category Rules:
Structural steels, 07.2014 (PCR tested and approved by the SVR)

Issue date
28/06/2018

Valid to
27/06/2023

Owner of the Declaration
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66, rue de Luxembourg
L-4221 Esch-sur-Alzette
Luxembourg

Declared product / Declared unit
The declared unit is 1 metric ton of EcoSheetPiles™.

Scope:
The declaration applies to 1 metric ton of EcoSheetPiles™. It covers hot rolled steel sheet piling (Z-shaped, U-shaped, straight-web, and H-shaped) produced by ArcelorMittal.

This environmental product declaration is valid for steel sheet piling produced by ArcelorMittal sites Differdange and Esch-Belval in Luxembourg and refers to 100% of the production volumes of 2015.

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.

Verification
The CEN Norm /EN 15804/ serves as the core PCR
Independent verification of the declaration according to /ISO 14025/
- [x] externally
- [ ] internally

Product

Product description / Product definition
Steel sheet piling are rolled steel profiles with longitudinal clutches at each side. Sheet piles can be connected to each other through these clutches creating a mechanical connection (i.e. interlock) between the profiles allowing the construction of a continuous wall.

This EPD applies to 1 metric ton of EcoSheetPiles™. EcoSheetPiles™ are produced at the ArcelorMittal sites Differdange and Esch-Belval in Luxembourg from ca. 100% scrap in an electric arc furnace route and are 100% reusable and recyclable. The types of EcoSheetPiles™ available are: Z-shaped, U-shaped, straight-web, and H-shaped.

Application
Sheet pile walls resist to high pressure and can support massive height of soil with a small quantity of steel compared to the applied loads. Steel piling products are used worldwide in many kinds of permanent or temporary structures: quay walls and breakwaters in harbors and locks, bank reinforcement on rivers and canals, pumping stations, bridge abutments, retaining walls for underpasses or underground car parks, impervious containment walls, temporary cofferdams in land and in water, containment barriers, and load bearing foundations, among others.

Technical Data
This EPD is valid for EcoSheetPiles™ steel piling products of varied grades and geometries, as well as different forms of delivery. Specific information on dimension tolerances, constructional data and mechanical and chemical properties can be found in the relevant standards /EN 10248/.

Constructional data

<table>
<thead>
<tr>
<th>Name</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density</td>
<td>7850</td>
<td>kg/m³</td>
</tr>
<tr>
<td>Modulus of elasticity</td>
<td>210000</td>
<td>N/mm²</td>
</tr>
<tr>
<td>Coefficient of thermal expansion</td>
<td>12</td>
<td>10⁻⁶K⁻¹</td>
</tr>
<tr>
<td>Thermal conductivity</td>
<td>48</td>
<td>W/(mK)</td>
</tr>
<tr>
<td>Melting point</td>
<td>1536</td>
<td>°C</td>
</tr>
</tbody>
</table>

Product standards and national certifications:
- European standard /EN 10248/ Hot rolled sheet piling of non-alloy steels
- ASTM international standards /ASTM A328/, /A572/, /A690/
Base materials / Ancillary materials
Steel piling products according to /EN 10248/ are non-alloy steel products, except for AMLoCor and ASTM A690 products. Iron is the main component of steel piling products. Alloying elements are added on the form of ferroalloys or metal, the most common elements are manganese, chromium and vanadium. Other elements like nitrogen or copper may be present in the steel. The composition of these elements depends on the steel designation/grade.

Reference service life
A reference service life for steel piling products is not declared. Steel piling products are construction products with many different application purposes.

LCA: Calculation rules
Declared Unit
The declaration refers to the functional unit of 1 metric ton of EcoSheetPiles™ as specified in Part B requirements on the EPD for structural steels.

<table>
<thead>
<tr>
<th>Declared unit</th>
<th>Name</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Declared unit</td>
<td>1</td>
<td>t</td>
</tr>
<tr>
<td></td>
<td>Conversion factor to 1 kg</td>
<td>0.001</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Density</td>
<td>7850</td>
<td>kg/m³</td>
</tr>
</tbody>
</table>

System boundary
Type of the EPD: cradle-to-gate - with options. Module A1-A3, Module C3 and module D were considered.

Modules A1-A3 of the EcoSheetPiles™ production include the following:
- The provision of resources, additives, and energy
- Transport of resources and additives to the production site
- Production processes on-site including energy, production of additives, disposal of production residues, and consideration of related emissions
- Recycling of production/manufacturing scrap. Steel scrap is assumed to reach the end-of-waste status once is shredded and sorted, thus becomes input to the product system in the inventory.

Module C3 takes into account the sorting and shredding of after-use steel that is recycled, as well as the non-recovered scrap due to sorting efficiency which is landfilled. A conservative value of 1% landfill is considered.

Module D refers to the End-of-Life of the sheet pile, including reuse and recycling.

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.

LCA: Scenarios and additional technical information
General
Depending upon the type of installation, it is possible to recover and reuse up to 100% of steel piling products. In general steel piling products are 100% recyclable. In this EPD a rate of 99% after dismantling is used, thanks to the magnetic properties of steel according to the /European Commission Technical Steel Research/ and the /German Ministry of Environmental Affairs/.

Reuse
Steel piling products can be reused several times. Part of the production is used for temporary works (lasting up to 3 years). Steel piling products can be reused from 3 to 10 times, without loss of their properties. The frequency of reuse varies depending on the use case. For instance, the same steel piling product can be used successively for different parts of a construction site or stocked by a company between two usages. According to internal documentation within ArcelorMittal, currently part of the sheet piles are reused several times, leading to an overall reuse rate of 25%.

Recycling
Steel can be recycled to the same (or higher/lower) quality of steel depending upon the metallurgy and processing of the recycling route. Steel piling products can be recycled without any problem after dismantling, and recycling routes are well established.

99% of the sheet piles are recovered for reuse and recycling. Since 25% of the sheet piles are reused, the remaining 74% is considered as recycled with the corresponding benefits and burdens. In module D the recycled material gets a credit based on the “value of scrap” methodology by /Worldsteel/ and the reused material receives a credit as avoided manufacturing of EcoSheetPiles™.

For specific case studies, dedicated scenarios can be calculated by contacting ArcelorMittal or using the data provided in this document.
### End of life (C3)

<table>
<thead>
<tr>
<th>Name</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Landfilling</td>
<td>1</td>
<td>%</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Name</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recycling</td>
<td>74</td>
<td>%</td>
</tr>
<tr>
<td>Reuse</td>
<td>25</td>
<td>%</td>
</tr>
</tbody>
</table>
### LCA: Results

#### RESULTS OF THE LCA - ENVIRONMENTAL IMPACT: 1 metric ton of EcoSheetPiles™

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>A1-A3</th>
<th>C3</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global warming potential</td>
<td>[kg CO₂-Eq.]</td>
<td>5.2E+2</td>
<td>2.03E+0</td>
<td>-3.23E+0</td>
</tr>
<tr>
<td>Depletion potential of the stratospheric ozone layer</td>
<td>[kg CFC11-Eq.]</td>
<td>6.37E-7</td>
<td>1.22E-9</td>
<td>-1.60E-7</td>
</tr>
<tr>
<td>Acidification potential of land and water</td>
<td>[kg SO₂-Eq.]</td>
<td>1.95E+0</td>
<td>6.38E-3</td>
<td>9.73E-4</td>
</tr>
<tr>
<td>Eutrophication potential</td>
<td>[kg PO₄-Eq.]</td>
<td>1.57E-1</td>
<td>8.86E-4</td>
<td>5.59E-6</td>
</tr>
<tr>
<td>Formation potential of tropospheric ozone photochemical oxidants</td>
<td>[kg ethene-Eq.]</td>
<td>1.71E-1</td>
<td>4.82E-4</td>
<td>2.36E-2</td>
</tr>
<tr>
<td>Abiotic depletion potential for non-fossil resources</td>
<td>[kg Sb-Eq.]</td>
<td>2.69E-4</td>
<td>6.28E-7</td>
<td>-0.00E+0</td>
</tr>
<tr>
<td>Abiotic depletion potential for fossil resources</td>
<td>[MJ]</td>
<td>6.15E+3</td>
<td>2.27E+1</td>
<td>-3.53E+2</td>
</tr>
</tbody>
</table>

#### RESULTS OF THE LCA - RESOURCE USE: 1 metric ton of EcoSheetPiles™

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>A1-A3</th>
<th>C3</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Renewable primary energy as energy carrier</td>
<td>[MJ]</td>
<td>8.54E+2</td>
<td>8.76E+0</td>
<td>-2.73E+2</td>
</tr>
<tr>
<td>Renewable primary energy as material utilization</td>
<td>[MJ]</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
</tr>
<tr>
<td>Total use of renewable primary energy resources</td>
<td>[MJ]</td>
<td>8.54E+2</td>
<td>8.76E+0</td>
<td>-2.73E+2</td>
</tr>
<tr>
<td>Non-renewable primary energy as energy carrier</td>
<td>[MJ]</td>
<td>9.56E+3</td>
<td>3.41E+1</td>
<td>-1.25E+3</td>
</tr>
<tr>
<td>Non-renewable primary energy as material utilization</td>
<td>[MJ]</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
</tr>
<tr>
<td>Total use of non-renewable primary energy resources</td>
<td>[MJ]</td>
<td>9.56E+3</td>
<td>3.41E+1</td>
<td>-1.25E+3</td>
</tr>
<tr>
<td>Use of secondary material</td>
<td>[kg]</td>
<td>1.09E+3</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
</tr>
<tr>
<td>Use of renewable secondary fuels</td>
<td>[MJ]</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
</tr>
<tr>
<td>Use of non-renewable secondary fuels</td>
<td>[MJ]</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
</tr>
<tr>
<td>Use of net fresh water</td>
<td>[M³]</td>
<td>3.52E+0</td>
<td>1.36E-2</td>
<td>-3.97E+1</td>
</tr>
</tbody>
</table>

#### RESULTS OF THE LCA - OUTPUT FLOWS AND WASTE CATEGORIES: 1 metric ton of EcoSheetPiles™

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>A1-A3</th>
<th>C3</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hazardous waste disposed</td>
<td>[kg]</td>
<td>6.56E-6</td>
<td>3.34E-7</td>
<td>-4.41E-8</td>
</tr>
<tr>
<td>Non-hazardous waste disposed</td>
<td>[kg]</td>
<td>7.14E+0</td>
<td>1.06E+1</td>
<td>1.13E-2</td>
</tr>
<tr>
<td>Radioactive waste disposed</td>
<td>[kg]</td>
<td>1.40E+0</td>
<td>4.54E-3</td>
<td>-3.71E-1</td>
</tr>
<tr>
<td>Components for reuse</td>
<td>[kg]</td>
<td>0.00E+0</td>
<td>2.53E+2</td>
<td>0.00E+0</td>
</tr>
<tr>
<td>Materials for recycling</td>
<td>[kg]</td>
<td>0.00E+0</td>
<td>7.40E+2</td>
<td>0.00E+0</td>
</tr>
<tr>
<td>Materials for energy recovery</td>
<td>[kg]</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
</tr>
<tr>
<td>Exported electrical energy</td>
<td>[MJ]</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
</tr>
<tr>
<td>Exported thermal energy</td>
<td>[MJ]</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
</tr>
</tbody>
</table>

Note: 1085 kg scrap is used to manufacture 1000 kg of EcoSheetPiles™. After use, 740 kg steel is recycled, 250 kg is reused. The potential environmental impact calculated for module D depends on the net amount of scrap left in the system, which is 740 - 1085 + 271 kg = -74 kg

This means that the system requires a net input of 74 kg of steel scrap, which contributes as an environmental burden in module D; this is overcompensated by the benefit of reuse, thus overall module D shows an environmental benefit.

### References

- **Institut Bauen und Umwelt**
  Institut Bauen und Umwelt e.V., Berlin(pub.):
  Generation of Environmental Product Declarations (EPDs);
  General Principles
  for the EPD range of Institut Bauen und Umwelt e.V. (IBU), 2013/04
  [www.ibu-epd.de](http://www.ibu-epd.de)

- **ISO 14025/**

- **DIN EN /ISO 14025:2011-10/**: Environmental labels and declarations — Type III environmental declarations — Principles and procedures

- **/EN 15804/**
  /EN 15804:2012-04+A1 2013/, Sustainability of construction works — Environmental Product Declarations — Core rules for the product category of construction products

- **/EN 10 248/**: Hot rolled sheet piling of non-alloy steels.
  Part 1: Technical delivery conditions; Part 2:
Tolerances on shape and dimensions.


/AMLoCor®, New corrosion resistant steel grade for marine applications. ArcelorMittal. http://sheetpiling.arcelormittal.com/page/index/name/a mlcor


/PCR 2014/, Part B, Requirements on the EPD for Structural steels -Institut Bauen und Umwelt e.V., Berlin (pub.): From the range of Environmental Product Declarations of Institute Construction and Environment e.V. (IBU) 2014


/German Ministry of Environmental Affairs/, "Instrumente zur Wiederverwendung von Bauteilen und hochwertigen Verwertung von Baustoffen", (Umweltforschungsplan des Bundesministeriums für Umwelt, Naturschutz, Bau und Reaktorsicherheit ; Forschungskennzahl 3712 32 319; UBA-FB 002208)

/Steel Recycling/, Steel recycling rates at a glance, 2007 Steel recycling rates; Steel Recycling Institute

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