ENVIRONMENTAL PRODUCT DECLARATION

as per *ISO 14025* and *EN 15804+A2*

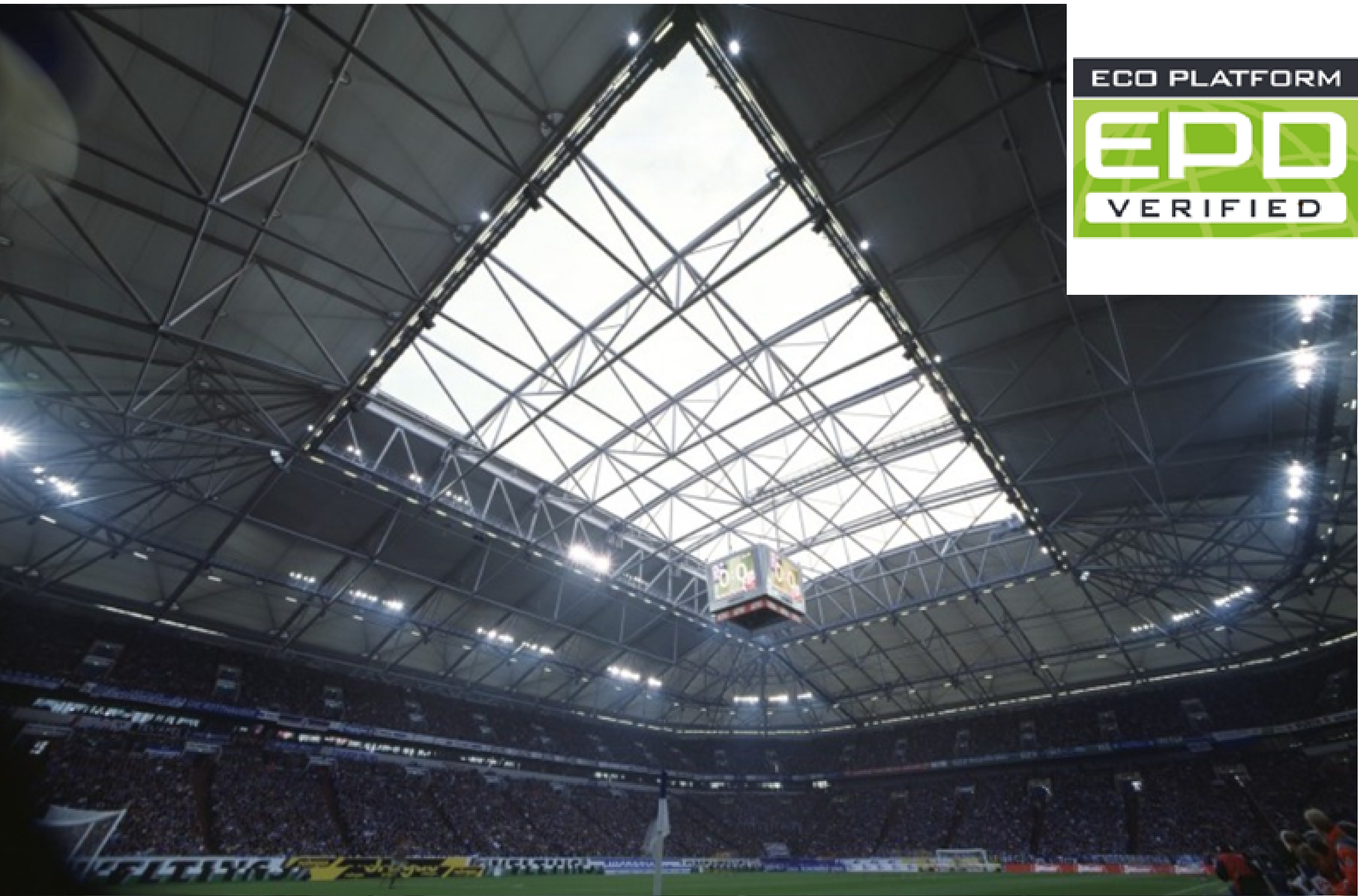
Owner of the Declaration	Salzgitter AG
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-SMM-20210244-IBB1-EN
Issue date	20.06.2022
Valid to	19.06.2027

Mannesmann MSH® Sections

Mannesmann Line Pipe GmbH

Institut Bauen und Umwelt e.V.

ECO PLATFORM EPD VERIFIED



1. General Information

Salzgitter AG	Mannesmann MSH® Sections
Programme holder IBU – Institut Bauen und Umwelt e.V. Hegelplatz 1 10117 Berlin Germany	**Owner of the declaration** Salzgitter AG Eisenhüttenstraße 99 38239 Salzgitter Germany
Declaration number EPD-SMM-20210244-IBB1-EN	**Declared product / declared unit** The Declaration refers to the production of 1 tonne Mannesmann MSH® sections.
This declaration is based on the product category rules: Structural steels, 11.2017 (PCR checked and approved by the SVR) **Issue date** 20.06.2022 **Valid to** 19.06.2027	**Scope:** This Environmental Product Declaration refers to Cold- and hot-finished Mannesmann MSH® sections with circular, square and rectangular cross-sections from the production facilities of **Mannesmann Line Pipe GmbH** in Hamm and Siegen (Germany). 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. The EPD was created according to the specifications of *EN 15804+A2*. In the following, the standard will be simplified as *EN 15804*.
Dipl. Ing. Hans Peters (chairman of Institut Bauen und Umwelt e.V.)	**Verification** The standard *EN 15804* serves as the core PCR Independent verification of the declaration and data according to *ISO 14025:2011* ☐ internally ☒ externally
Dr. Alexander Röder (Managing Director Institut Bauen und Umwelt e.V.))	Dr.-Ing. Wolfram Trinius (Independent verifier)

2. Product

2.1 Product description/Product definition

Mannesmann MSH® sections are cold- and hot-finished hollow sections for structural steel which are manufactured from unalloyed structural steels and fine-grain steels, e.g. in accordance with:

EN 10210, Hot-finished structural hollow sections of non-alloy and fine-grain steels

or

EN 10219, Cold-formed welded structural steel hollow sections

Product definition:

(EU) Directive No. 305/2011 (CPR) applies for placing the product on the market in the EU/EFTA (with the exception of Switzerland). The product requires a Declaration of Performance taking consideration of the *EN 10210* or *EN 10219* and CE marking.

The respective national regulations apply for usage. Application of the products in Germany is subject to the following guidelines:

1. *DIN 18800* to *DIN 18808*: German application standards for steel construction

2. Eurocode 3: (*EN 1993-1-1* to *EN 1993-1-12*): European application standards for steel construction

3. DASt guidelines: supplementary guidelines, published by the Deutscher Ausschuss für Stahlbau (DASt) technical delivery conditions; German version *EN 10025*

2.2 Application

Mannesmann MSH® sections are used in numerous construction applications. Typical examples include:

- Industrial buildings and halls
- Bridge construction

- Sports facilities
- Airport terminals and hangars
- Offshore constructions

2.3 Technical Data

The mechanical and technological properties of cold- and hot-finished hollow sections are indicated in delivery standards such as Tables A.3 (unalloyed structural steel) and B.3 (fine-grain steel) in *EN 10210* or Table A.3 (unalloyed structural steel) in *EN 10219* and Tables B.4 or B.5 for the treatment conditions of the preliminary material N and M.

The Declaration of Performance shall apply.

Technical construction data

Name	Value	Unit
Density	7850	kg/m^3
Modulus of elasticity	210000	N/mm^2
Coefficient of thermal expansion	11,5 - 11,9	$10^{-6}K^{-1}$
Thermal conductivity	35 - 47	W/(mK)
Melting point	1538	°C
Electrical conductivity at 20°C	3,8 - 4,0	$\Omega^{-1}m^{-1}$
Minimum yield strength (for sheet steel)	235 - 460	N/mm^2
Minimum tensile strength (for sheet steel)	360 - 720	N/mm^2

Product according to CPR with hEN:

The product's performance values correspond with the Declaration of Performance in terms of its essential properties in accordance with

- ***EN 10210*:**Hot-finished structural hollow sections of non-alloy and fine-grain steels, Part 1: Technical delivery conditions; Part 2: Tolerances, dimensions and sectional properties
- ***EN 10219:***Cold-formed welded structural steel hollow sections, Part 1: Technical delivery conditions (EN 10219); Part 2: Tolerances, dimensions and sectional properties (EN 10219-2)

2.4 Delivery status

e.g. materials in accordance with *EN 10210* and *EN 10219*

Steel grades:

- S235JRH – S460NLH
- S235JRH – S460MLH

Ultra high-strength grades as TM or QT variants are available on request.

2.5 Base materials/Ancillary materials

The base material for manufacturing hot-rolled coils as a preliminary material for cold- and hot-finished hollow sections is iron (percentage by mass >= 99.5%).

Other components are carbon, silicon and manganese. Chemical composition varies depending on the type of steel. The detailed percentages by mass are indicated in the *EN 10210* and *EN 10219* product standards.

Ancillary materials:
Various lubricants depending on the respective rolling process

The product contains substances from the *ECHA* list of candidates of Substances of Very High Concern (SVHC) (dated 17 January 2022) exceeding 0.1 percentage by mass: **no**

The product contains other CMR substances in categories 1A or 1B which are not on the candidate list, exceeding 0.1 percentage by mass in at least one partial product: **no**

Biocide products were added to this construction product or it has been treated with biocide products (this then concerns a treated product as defined by the Ordinance on Biocide Products No. (EU) 528/2012): **no**

2.6 Manufacture

Hot-rolled strips of suitable width and sheet thickness, wound as coils, represent the preliminary material for manufacturing longitudinal seam-welded steel pipes at Mannesmann Line Pipe. There are two production facilities with identical manufacturing methods located in Siegen and Hamm.

<u>Pipe production (circular hollow sections):</u>
The process is broken down into three phases: **forming** the infinitely welded strip as open-seam pipes, **welding** and **annealing** the seam for achieving the requisite structure. The heated strip edges are welded together by pressing. The pipes are rounded and aligned followed by non-destructive testing of the HFI seam. The pipe string is then sawn to the desired length for the requisite round hollow section.

<u>Processing (hot-finished round, square and rectangular hollow sections):</u>
The cold-finished circular pipes referred to above are heated to >870 °C solid body for manufacturing hot-finished circular hollow sections and for reforming as square and rectangular sections using four inductors. Production speed ranges from 0.5 to 4.0 m/min.

Both sites are certified to *ISO 9001* for product manufacturing and quality assurance.

2.7 Environment and health during manufacturing

During the entire manufacturing process, no other health protection measures are required extending beyond the legally specified industrial protection measures for commercial enterprises.

Certification of industrial safety and health protection in accordance with *ISO 45001* is in place for both sites.

Via regular analyses of the environmental impacts and permanent improvement measures and action within the framework of TQM (Total Quality Management), the low environmental impacts attributable to the manufacturing process are continuously minimised.

Both production facilities operated by Mannesmann Line Pipe GmbH are certified to *ISO 14001*.

2.8 Product processing/Installation

Processing recommendations:

Hot- and cold-forming:
Hot- and cold-forming are possible without any difficulty. Hot-forming should be carried out in a range of 1050 to 750 °C. Forming with a predominantly upsetting component, e.g. forging, **can** be carried out in the upper temperature range. Forming operations with stretching, on the other hand, **should** be carried out in the lower temperature range. The temperature can decrease to 700 °C for degrees of deformation of less than 5% in the final stage.
This must be followed by cooling down in stationary air. After hot-forming, normalising is necessary if temperatures arose outside the temperature range of 980 to 850 °C during the previous forming process. After stronger cold-forming processes requiring heat treatment in accordance with the respective guidelines (see *AD data sheets*), stress-relief heat treatment is often sufficient unless other acceptance test procedures or other specifications expressly demand normalising.

Welding:
The steels can be welded manually or automatically after each of these procedures. At external temperatures below approx. +5 °C and wall thicknesses exceeding 50 mm (for S 355 and higher exceeding 30 mm), preheating a sufficiently wide zone to 80 to 200 °C is recommended. In any case, the surface should be free of condensation. Stress-relief heat treatment (see heat treatment) is not generally necessary and it should only be carried out if demanded by a building regulation or when welded constructions and/or operating conditions commend depletion of the internal welding stresses. Verifiably suitable welding additives must be used for arc welding while alkaline welding additives are preferable for S 355 and higher.

Industrial safety and health protection measures:
No health protection measures over and beyond the standard industrial safety measures (e.g. protective gloves) are required during processing/installation of the Mannesmann MSH® sections.

Environmental protection measures:
No noteworthy environmental pollution is triggered by processing/assembling the products in question. No special measures need to be taken to protect the environment.

Residual material incurred:
Residual material and packaging incurred on the building site must be collected separately. The specifications of local waste authorities must be maintained during processing.

2.9 Packaging
Mannesmann MSH® sections (angular or circular) are bundled using steel bands and/or shipped on wooden beams, secured with wooden wedges (waste code nos.: 150103 packaging made of wood, 150104 packaging made of metal). All packaging can be reused.

2.10 Condition of use
Contents in condition of use:
The material composition during the use phase is the same as at the time of production. Mannesmann MSH® sections are manufactured from non-alloy structural steels and fine-grain structural steels in accordance with *EN 10210* and *EN 10219*. Contents are listed in Table 2.1 in section 2.

Corrosion protection:
Detailed information on corrosion protection is available in the technical information sheet entitled “Protecting hollow sections from corrosion” on *Mannesmann Line Pipe*.

2.11 Environment and health during use
General health and environmental aspects
There are no health risks for users of Mannesmann MSH® sections or for persons manufacturing or processing Mannesmann MSH® sections. From an environmental perspective, there are no restrictions governing the use of Mannesmann MSH® sections.

2.12 Reference service life
Building product life cycles are dependent on the respective building design, use and maintenance. The use phase for structural hollow sections is not depicted as they involve maintenance-free and generally durable products.

2.13 Extraordinary effects

Fire
Mannesmann MSH® sections comply with the requirements of construction product class A1 “non-flammable” in accordance with *DIN 4102-1* and *EN 13501*. No smoke gas develops.

Fire Protection

Name	Value
Building material class	A1

Water
The effects of flooding on Mannesmann MSH® sections do not lead to any changes in the product or any other negative environmental impact.

Mechanical destruction
In the event of extraordinary mechanical impact, steel structures display very good characteristics thanks to the high degree of ductility (malleability) of the material. As a general rule, no chips, breaking edges or similar are incurred.

2.14 Re-use phase
Mannesmann MSH® sections are 100% recyclable. The Mannesmann MSH® sections used in a structure are only partially reused after demolition; the largest share is primarily directed to electro-steel plants as scrap.

2.15 Disposal
As steel is 100% recyclable, this material does not require disposal. Waste code in accordance with the European List of Wastes (EWC), as per the European List of Wastes Ordinance *AVV*: 17 04 05 Iron and steel.

2.16 Further information
Further information on Mannesmann MSH® sections is available on *Mannesmann Line Pipe*.

3. LCA: Calculation rules

3.1 Declared Unit
As a representative of the group of cold- and hot-finished Mannesmann MSH® sections, 1 tonne hot-finished Mannesmann MSH® section serves as the declared unit.

Declared Unit

Name	Value	Unit
Declared unit	1	t
Thickness (max. wall thickness)	25,4	mm
Density	7850	kg/m³
Conversion factor to 1 kg	0.001	-

3.2 System boundary
Type of EPD: cradle to gate with Modules C1 - C4 and Module D.

The EPD comprises the following life cycle phases:

- Product stage (Modules A1 - A3)
- End-of-Life stage (Modules C1 - C4)
- Benefits and loads beyond the system boundary (Module D)

Modules A1 - A3 cover both the upstream chain of production and provision of raw materials, auxiliary materials and energy sources, the production of hot strip on the basis of iron ore, as well as its transport to the plants of Mannesmann Line Pipe GmbH, and the energy and material costs there. Waste water treatment is also considered.

For Module C2 (Transport), it is assumed that the steel scrap is transported 100 km by truck for further processing. No other expenses are incurred in Module C, or are already included in the other modules (e.g. recycling in the electric arc furnace and in the converter).

Module D takes consideration of the reuse and recycling potential. Recycling credits are allocated in line with the “theoretically 100% primary furnace route” approach, in accordance with *Worldsteel 2017*.

3.3 Estimates and assumptions
Estimates and assumptions were documented in detail and are based on real production data from hot strip and steel pipe production.

3.4 Cut-off criteria
The end-of-life scenario involves product losses of 3.1%. Landfilling is not considered. Likewise, the manufacture and utilisation of packaging material (steel bands, wooden beams) are not considered. Nor is the use of lubricants taken into consideration.

In their entirety, these unconsidered flows significantly comply with the cut-off criterion of max. 5% of energy and mass expenditure while also adhering to the criterion of 1% in relation to individual processes, *PCR, Part A + A2*.

3.5 Background data
The LCA results of the declared product are based on modelling in the *GaBi ts* software environment.

Modelling is based on primary production data for the production of hot strip and the energy and media consumption values for an entire year.

This has been supplemented by secondary data from the GaBi database. The respective documentation can be viewed online.

3.6 Data quality
All primary data on steel/hot strip production and pipe production refers to the financial year 2018. The annual volumes have been examined for representativity in relation to previous financial years.

The current GaBi database (GaBi version 10.5.1.124, database 2021.2) was used for background data sets.

The assessment model of the “Product Environmental Footprint (PEF)” approach (see *PEF*) of the EC Joint Research Centre 2012 was used to assess the quality of the primary and secondary data in this EPD. Accordingly, the overall data quality can be rated as “very good”.

3.7 Period under review
The period under review is fiscal 2018. The volumes of hot-finished Mannesmann MSH® sections produced in 2018 serve as averages for the Declaration.

3.8 Allocation
The methodology used for the co-products in the "coking plant" and "power plant" processes of primary steel production was physical allocation based on calorific value. For the other co-products, a partitioning approach based on the product energy content was used according to the recommendation of *Worldsteel 2014*.

The use of steel scrap for the production of hot strip in Module A1 is considered unencumbered. However, a large percentage of scrap requirements is already covered by the cutting losses incurred during pipe production.

The remaining residual quantity is fed into Module A1 before the End-of-Life scenario is considered and deducted from the “scrap for recycling” material flow. The difference is the net scrap quantity that is transferred to the recycling process; please refer to *Helmus*. Recycling credits are allocated in line with the “theoretically 100% primary furnace route” approach, *Worldsteel 2014*.

If reused, this material flow is credited to pipe production (Modules A1-A3).

3.9 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.

The background database used involves the *GaBi* data base, version 2021.2.

4. LCA: Scenarios and additional technical information

Characteristic product properties
Information on biogenic Carbon

End of life (C1 - C4)

Name	Value	Unit
Collected separately	969	kg
Reuse	53	kg
Recycling (net flow steel scrap)	914	kg

Reuse, recovery and recycling potential (D), relevant scenario information

Name	Value	Unit
Collection Rate	96,9	%
Recycling	91,6	%
Reuse	5,3	%
Loss	3,1	%

5. LCA: Results

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; ND = MODULE OR INDICATOR NOT DECLARED; MNR = MODULE NOT RELEVANT)

PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARIES
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
A1	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
X	X	X	ND	ND	ND	ND	MNR	MNR	MNR	ND	ND	X	X	X	X	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT according to EN 15804+A2: 1 tonne Mannesmann MSH® sections

Core Indicator	Unit	A1-A3	C1	C2	C3	C4	D
Global warming potential - total	[kg CO_2-Eq.]	2.55E+3	0.00E+0	6.77E+0	0.00E+0	0.00E+0	-1.62E+3
Global warming potential - fossil fuels	[kg CO_2-Eq.]	2.55E+3	0.00E+0	6.72E+0	0.00E+0	0.00E+0	-1.62E+3
Global warming potential - biogenic	[kg CO_2-Eq.]	4.00E+0	0.00E+0	-8.08E-3	0.00E+0	0.00E+0	1.94E+0
GWP from land use and land use change	[kg CO_2-Eq.]	1.56E+0	0.00E+0	5.54E-2	0.00E+0	0.00E+0	-2.77E-1
Depletion potential of the stratospheric ozone layer	[kg CFC11-Eq.]	3.74E-8	0.00E+0	1.34E-15	0.00E+0	0.00E+0	-2.82E-8
Acidification potential, accumulated exceedance	[mol H^+-Eq.]	7.05E+0	0.00E+0	4.02E-2	0.00E+0	0.00E+0	-4.71E+0
Eutrophication, fraction of nutrients reaching freshwater end compartment	[kg P-Eq.]	2.69E-3	0.00E+0	2.01E-5	0.00E+0	0.00E+0	-5.12E-4
Eutrophication, fraction of nutrients reaching marine end compartment	[kg N-Eq.]	1.55E+0	0.00E+0	1.97E-2	0.00E+0	0.00E+0	-9.08E-1
Eutrophication, accumulated exceedance	[mol N-Eq.]	1.68E+1	0.00E+0	2.18E-1	0.00E+0	0.00E+0	-9.86E+0
Formation potential of tropospheric ozone photochemical oxidants	[kg NMVOC-Eq.]	4.42E+0	0.00E+0	3.79E-2	0.00E+0	0.00E+0	-2.43E+0
Abiotic depletion potential for non-fossil resources	[kg Sb-Eq.]	5.17E-4	0.00E+0	6.01E-7	0.00E+0	0.00E+0	-2.67E-4
Abiotic depletion potential for fossil resources	[MJ]	2.44E+4	0.00E+0	9.03E+1	0.00E+0	0.00E+0	-1.33E+4
Water (user) deprivation potential, deprivation-weighted water consumption (WDP)	[m^3 world-Eq deprived]	4.79E+0	0.00E+0	6.29E-2	0.00E+0	0.00E+0	-5.66E-1

RESULTS OF THE LCA - INDICATORS TO DESCRIBE RESOURCE USE according to EN 15804+A2: 1 tonne Mannesmann MSH® sections

Indicator	Unit	A1-A3	C1	C2	C3	C4	D
Renewable primary energy as energy carrier	[MJ]	2.20E+3	0.00E+0	5.20E+0	0.00E+0	0.00E+0	1.55E+3
Renewable primary energy resources as material utilization	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Total use of renewable primary energy resources	[MJ]	2.20E+3	0.00E+0	5.20E+0	0.00E+0	0.00E+0	1.55E+3
Non-renewable primary energy as energy carrier	[MJ]	2.45E+4	0.00E+0	9.06E+1	0.00E+0	0.00E+0	-1.34E+4
Non-renewable primary energy as material utilization	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Total use of non-renewable primary energy resources	[MJ]	2.45E+4	0.00E+0	9.06E+1	0.00E+0	0.00E+0	-1.34E+4
Use of secondary material	[kg]	1.88E+2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	9.14E+2
Use of renewable secondary fuels	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Use of non-renewable secondary fuels	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Use of net fresh water	[m^3]	4.79E+0	0.00E+0	5.95E-3	0.00E+0	0.00E+0	-5.66E-1

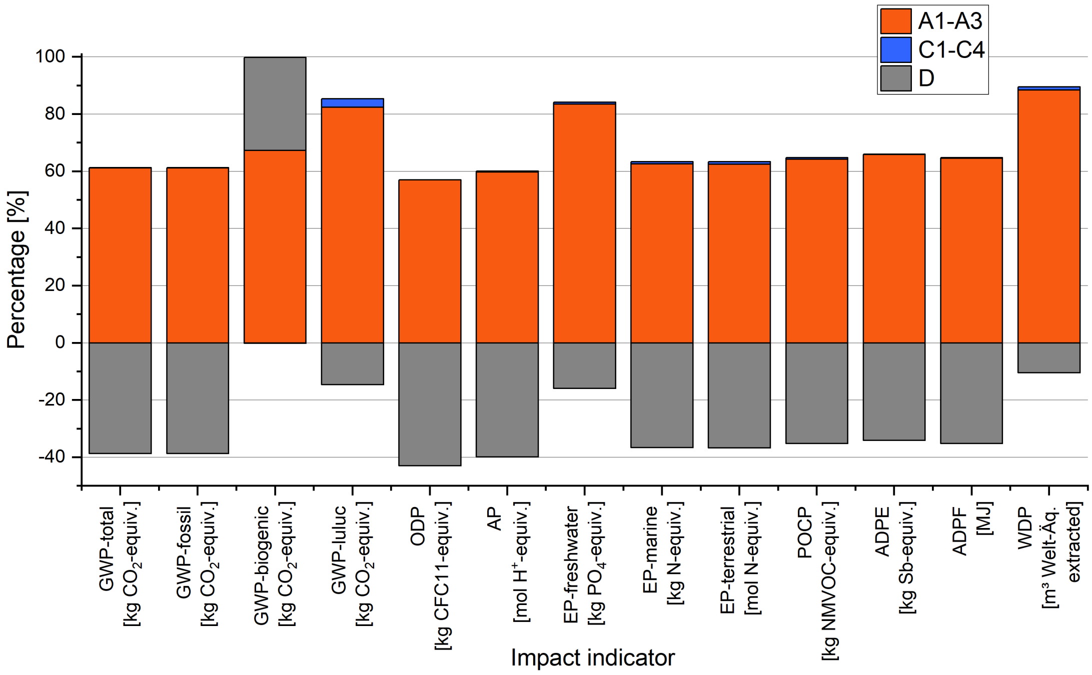
RESULTS OF THE LCA – WASTE CATEGORIES AND OUTPUT FLOWS according to EN 15804+A2: 1 tonne Mannesmann MSH® sections

Indicator	Unit	A1-A3	C1	C2	C3	C4	D
Hazardous waste disposed	[kg]	2.34E+0	0.00E+0	4.78E-9	0.00E+0	0.00E+0	-1.25E-1
Non-hazardous waste disposed	[kg]	2.89E+1	0.00E+0	1.42E-2	0.00E+0	0.00E+0	-2.42E+1
Radioactive waste disposed	[kg]	2.67E-1	0.00E+0	1.64E-4	0.00E+0	0.00E+0	1.84E-1
Components for re-use	[kg]	0.00E+0	0.00E+0	0.00E+0	5.30E+1	0.00E+0	0.00E+0
Materials for recycling	[kg]	1.89E+2	0.00E+0	0.00E+0	9.16E+2	0.00E+0	0.00E+0
Materials for energy recovery	[kg]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Exported electrical energy	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Exported thermal energy	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0

RESULTS OF THE LCA – additional impact categories according to EN 15804+A2-optional: 1 tonne Mannesmann MSH® sections

Indicator	Unit	A1-A3	C1	C2	C3	C4	D
Potential incidence of disease due to PM emissions	[Disease Incidence]	ND	ND	ND	ND	ND	ND
Potential Human exposure efficiency relative to U235	[kBq U235-Eq.]	ND	ND	ND	ND	ND	ND
Potential comparative toxic unit for ecosystems	[CTUe]	ND	ND	ND	ND	ND	ND
Potential comparative toxic unit for humans - cancerogenic	[CTUh]	ND	ND	ND	ND	ND	ND
Potential comparative toxic unit for humans - not cancerogenic	[CTUh]	ND	ND	ND	ND	ND	ND
Potential soil quality index	[-]	ND	ND	ND	ND	ND	ND

6. LCA: Interpretation



The results of the environmental impact show that practically the “entire greenhouse gas emissions (**GWP total**)” of Modules A1 - A3 come from fossil sources (cf. indicator **GWP fossil**).
As expected, the more detailed analysis shows that hot strip production (Module A1) has the greatest influence on GWP total or GWP fossil, accounting for almost 94%. Here, the fossil carbon input in the blast furnace process is particularly noteworthy, leading to direct, process-related CO_2 emissions and to further indirect emissions in the power plant process. Within Module A1, approx. 70% of greenhouse gas emissions come from the direct plant emissions and the remainder from the emissions of the preliminary processes for the production and provision of the raw materials such as the coal, iron ore carriers and lime. In Module A3 (“Pipe production”), the majority of greenhouse gas emissions are accounted for by upstream emissions in the production of electricity.

In contrast, the absolute shares of the “greenhouse potentials from biogenic sources (**GWP biogenic**)” and from “landscape use and landscape use change (**GWP luluc**)” have only a negligible share of the total greenhouse potential. As expected, the contributions in Modules A1 and A3 come exclusively from the upstream processes, and here primarily from the electricity mix used or the raw material supplies.

For the "Water depletion potential (user) (**WEP**)", the chains of electricity generation to cover the electricity demand in Module A3 are decisive.

The other core indicators of environmental impacts are predominantly determined by steel and hot strip production in Module A1. The “Potential for stratospheric ozone depletion (**ODP**)” should be emphasised. The ODP is almost exclusively caused by the use of methanol in wastewater treatment in Module A1, as halogenated hydrocarbons are emitted during the production of methanol.

For the remaining impact indicators, the provision of raw materials for steel production (Module A1) also has the greatest influence on the absolute size of the environmental indicators. As expected, the largest contributions are made by the provision of iron ore carriers, coal and lime, i.e. those input materials that are used in the largest quantities (see Table 7). In addition, the impact indicators describing the acidification potential (**AP**), the eutrophication potential (**EP freshwater**, **EP marine**, **EP terrestrial**) and the ozone creation potential (**POCP**) are increased by the direct NO_x and SO_2 emissions of the sintering plant and the power plant.

The credits from the reuse and recycling of steel scrap in Module D result from the selected recycling approach of avoided primary steel production and the associated avoidance of emissions from this process route. The positive share of the impact indicator **GWP biogenic** of Module D comes from the biogenic shares of the German electricity mixes used.

In contrast to fossil-based primary steel production recycling by means of the electric arc process is mainly based on electricity. This is largely made up of renewable energies. For this reason, “Module D” leads to an increase rather than a decrease in the use of renewable energy, while at the same time reducing the use of fossil energy, as can be seen from the indicators **PERE** and **PENRE**.

In summary, almost every LCA indicator is determined by the steel production process in Module A1. Only electricity generation and its upstream chains have a significant overall impact on the pipe manufacturing process (Module A3). For Mannesmann Line Pipe, material efficiency is therefore the biggest lever in this and most categories.

7. Requisite evidence

This EPD concerns semi-finished products made from structural steel. Further processing depends on the respective application. Accordingly, further documentation is not of relevance here.

7.1 Weathering

Components manufactured from Mannesmann MSH® sections are not generally exposed to weathering without protection. Corrosion protection systems are selected in accordance with the respective application and site.

8. References

Standards

DIN 4102
DIN 4102-1:1998-05, Fire behaviour of building materials and building components – Part 1: Building materials, terms, requirements and tests

DIN 18800
DIN 18800-1:2008-11, Steel structures – Part 1: Rating and construction

DIN 18808
DIN 18808:1984-10, Steel structures; Supporting structures made of hollow sections under predominantly static loads

EN 1993-1-1
Eurocode 3: Rating and construction of steel structures – Part 1-1: General rules and rules for buildings; German version EN 1993-1-1:2005 + AC:2009
DIN EN 1993-1-1:2010-12

EN 1993-1-12
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