Corrugated Steel Pipe

Environmental Product Declaration (EPD)

corrugated steel pipe institute

The Corrugates Steel Pipe Institute (CSPI) is pleased to present this environmental product declaration (EPD) for Corrugated steel pipe. This EPD was developed in compliance with CAN/CSA-ISO 14025 and ISO 21930 and has been verified under Groupe AGÉCO.

The EPD includes life cycle assessment (LCA) results for raw material supply, transport and manufacturing and end of life (cradle-to-gate with options).

For more information about CSPI, please go to https://cspi.ca/

Environmental Product Declaration

CSA Group Registered Based on ISO 14025 and Other Requirements
For more information visit csaregistries.ca/epd

5720-1800
October 2024-October 2029

This environmental product declaration (EPD) is in accordance with CAN/CSA-ISO 14025 and ISO 21930 (if applicable) the PCR noted below. EPDs from different programs may not be comparable.

PROGRAM OPERATOR	CSA Group 178 Rexdale Blvd Toronto, ON Canada M9W 1R3 www.csagroup.org
GENERAL PROGRAM INSTRUCTION AND VERSION	CSA-SDP-5-13 CSA Group program operator rules for Type III environmental product declarations (2013)
MANUFACTURE NAME AND ADDRESS	Corrugated Steel Pipe Institute (CSPI) 6-100 Idle Creek Dr, Kitchener, Ontario, N2A 4H3
DECLARATION NUMBER	#5720-1800
DECLARED PRODUCT AND FUNCTIONAL UNIT	One metric ton of Corrugated Steel Pipe
REFERENCE PCR AND VERSION NUMBER	Product Category Rule Guidance for Building-Related Products and Services Part A: Life Cycle Assessment Calculation Rules and Report Requirements (version 4.0) UL Environment – Valid from March 2022 until March 2027. Product Category Rule Guidance for Building-Related Products and Services Part B: Designated Steel Construction Product EPD Requirements (version 2.0) UL Environment - Valid from August 2020 until August 2025 UN CPC code: 412
PRODUCT'S INTENDED APPLICATION AND USE	Construction and drainage applications
MARKETS OF APPLICABILITY	Canada
DATE OF ISSUE	October 30, 2024
PERIOD OF VALIDITY	October 30, 2024 to October 29, 2029
EPD TYPE	Industry-average
DATASET VARIABILITY	See Table 10
EPD SCOPE	Cradle to gate with options
YEAR OF REPORTED PRIMARY DATA	2022
LCA SOFTWARE AND VERSION NUMBER	GaBi version 10.7
EPD RECIPIENT ORGANIZATION	Corrugated Steel Pipe Institute

LCI DATABASES & VERSION NUMBER	Gabi 10.7, Ecoinvent 3.8 Background dataset for North American hot-rolled coil, published by American Iron and Steel Institute (AISI, 2020) LCI of steel scrap from Worldsteel Association (2021)
LCIA METHODOLOGY & VERSION NUMBER	TRACI 2.1 and IPCC 2013 AR5
The PCR review was conducted by:	Thomas Gloria, Industrial Ecology Consultants (chair) 35 Bracebridge Rd. Newton MA 02459 t.gloria@industrial-ecology.com Brandie Sebastian, JBE Consultants James Littlefield, Independent Consultant
This declaration was independently verified in accordance with ISO 14025:2006. The UL Environment "Part A: Calculation Rules for the life cycle assessment and Requirements on the Project Report" v4.0 (March 2022), in conformance with ISO ISO 21930:2017, serves as the core PCR, with additional considerations from the USGBC/UL Environment Part A Enhancement (2017)	_ Internal X External
This life cycle assessment was conducted in accordance with ISO 14044 and the reference PCR by:	Farid Safari ArcelorMittal Global R&D 1330 Burlington St. E Hamilton, ON, L8S 3K2
This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by:	Hugues Imbeault-Tétreault Groupe AGÉCO 1995, Frank-Carrel Street, suite 219 Quebec (Quebec) G1N 4H9

Limitations

The environmental impact results of steel products in this document are based on a declared unit and therefore do not provide sufficient information to establish comparisons. The results shall not be used for comparisons without knowledge of how the physical properties of the steel product impact the precise function at the construction level. The environmental impact results shall be converted to a functional unit basis before any comparison is attempted. See Section 3.10 for additional EPD comparability guidelines. Environmental declarations from different programs (ISO 14025) may not be comparable.

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1. DESCRIPTION OF ORGANIZATION

The Corrugated Steel Pipe Institute (CSPI) is the Association in Canada, representing corrugated steel pipe (CSP) manufacturers and suppliers. Members come from seven different countries and four different continents. The CSPI is an impartial organization that works with our member manufacturers, plus engineers and municipalities around the world, to gather data and information to make CSPI the essential information resource for water and soil management in Canada.

CSPI promotes CSP and sustainable engineering practices as the most effective means of managing, directing, and containing the forces of soil and water. We help all CSP users maximize CSP's advantages of superior strength, versatility, and sustainability through flexible and versatile solutions. These CSP solutions preserve environments, both natural and built up, plus promote public safety, manage, or detain water, and much more. Working closely with our members, CSPI also helps develop new product standards, recommended designs, installations, and applications. With more than 100 years of engineering expertise behind us, CSPI provides assistance to the public, government officials, and engineers in finding the right CSP solutions for projects and obtaining the greatest value for today's dollar.

2. DESCRIPTION OF PRODUCT

2.1 STANDARDS

The corrugated steel pipe in this EPD is specified by CSA G401 standard.

2.2 PRODUCT CLASSIFICATIONS AND APPLICATIONS

Corrugated steel conduits are manufactured from Galvanized, Aluminized or Galvalume (zinc, aluminium or 55% Aluminium 45% zinc coating) in a wide range of cross-sectional shapes, sizes, applications highlighted in Figure 1. CSP is identified under corrugated steel pipe Construction Specifications Institute (CSI) master format code, and the UNSPSC code class is 40171500. Also, the CSI classification number is 33 05 27 for corrugated metal culvert pipe.

Shape	Range of sizes	Common uses
Round	150 mm –. 15.8 m	Culverts, subdrains, sewers, service tunnels, etc. All plates same radius. For medium and high fills (or trenches)
Vertical ellipse **5% nominal**	2,440 mm – 6,400 mm nominal; before elongating	Culverts, sewers, service tunnels, recovery tunnels. Plates of varying radii; shop fabrication. For appearance and where backfill compaction is only moderate

Pipe-arch	Span x Rise: 450 mm x 340 mm – 7620 mm x 4240 mm	Where headroom is limited. Has hydraulic advantages at low flows.
Underpass	Span x Rise: 1,755 mm x 2,005 mm – 40 m x 15 mm	For pedestrians, livestock, or vehicles.
Arch	Span x Rise: 1,520 mm x 810 mm – 40 m x 15 m	For low clearance large waterway openings and aesthetics.

Figure 1. Typical shapes and uses of corrugated conduit

2.3 MATERIAL CONTENT

Section 4 of the CSA G401 standard for corrugated steel pipe specifies the material content and properties. According to G401-24 standard of Canadian Standard Association (CSA) for corrugated steel pipe[i], The following table provides the typical weight percentage for the steel substrates and metallic coating.

Table 1: Material content for corrugated steel pipe

Material	Thickness and Coating Weight	Average (kg/m²)	Average content in total weight (%)
Non coated steel substrate	1.6 mm (16 gauge)	12.53	95.4%
Metallic coating (Zinc or equivalent) *	610 g/m² (G200)	0.61	4.6%
Total		13.14	100%

*Zinc is a typical metallic coating; other metallic coatings include Aluminized type 2 or Galvalume™ (55% Aluminum, 45% zinc)

Also, the following table from CSA G401 shows the chemical composition requirements of the steel substrate.

Table 2. Chemical composition of steel

Element*	Corrugated steel pipe and spiral rib pipe	Structural plate CSP	Deep corrugated structural plate	Chemical limits for longitudinal flange connections
Carbon	0.15	0.10	0.25	0.22
Manganese	0.6	0.50	1.50	1.50
Phosphorus	0.08	0.08	0.08	0.04
Sulphur	0.05	0.05	0.04	0.05

* To avoid brittle steel behaviour, a minimum of 0.02% carbon content shall be used.

Steel products do not present inhalation, ingestion, or contact health hazards. These products do not include materials or substances that have a potential route of exposure to humans or flora/fauna in the environment.

3. SCOPE OF EPD

3.1 DECLARED UNIT

In accordance with the PCR, the declared unit and product density are shown in Table 3.

Table 3. Declared unit for corrugated steel conduits and the approximate density.

Parameter	Value
Declared Unit	1 metric ton
Density*	7,830 kg/m³

*A round CSP with profile of 125 x 25mm, 1800 mm diameter, 1.6 mm thickness and 11.8 m length has a mass of 1 metric ton.

3.2 AVERAGING PRINCIPLE

The AISI North American hot dip galvanized coil data set is based on a weighted average (average calculated based on the site-specific hot dip galvanized production volume) of North American steel producers. The AISI LCIs are calculated vertically. A classical vertical aggregation is taken into account at the production site level; data are yielded all along the processes on site. Figure 2 shows these approaches:

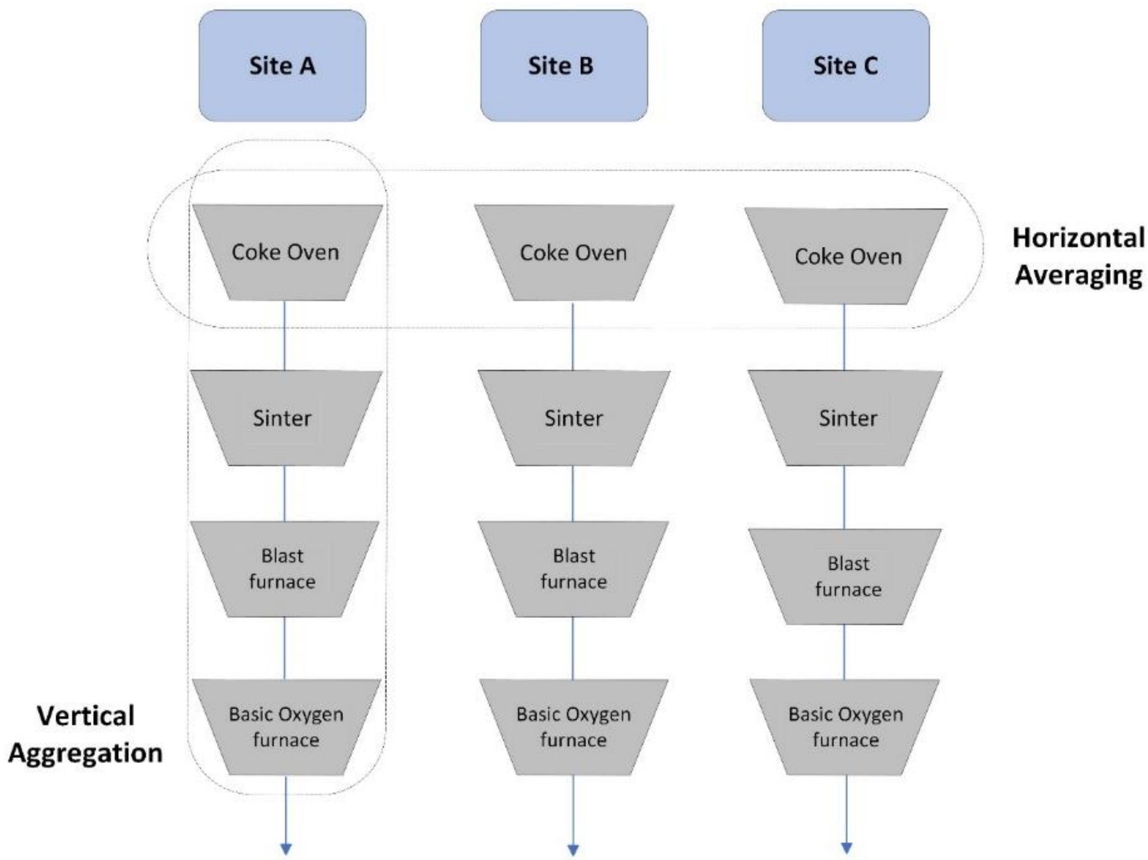

Figure 2: Horizontal averaging and vertical aggregation

3.3 PRODUCT LIFE CYCLE FLOW DIAGRAM

The diagram below (Figure 3) is a representation of the most significant contributions to the production of corrugated steel conduits. This includes resource extraction, steelmaking, transport to fabrication shops, and product fabrication.

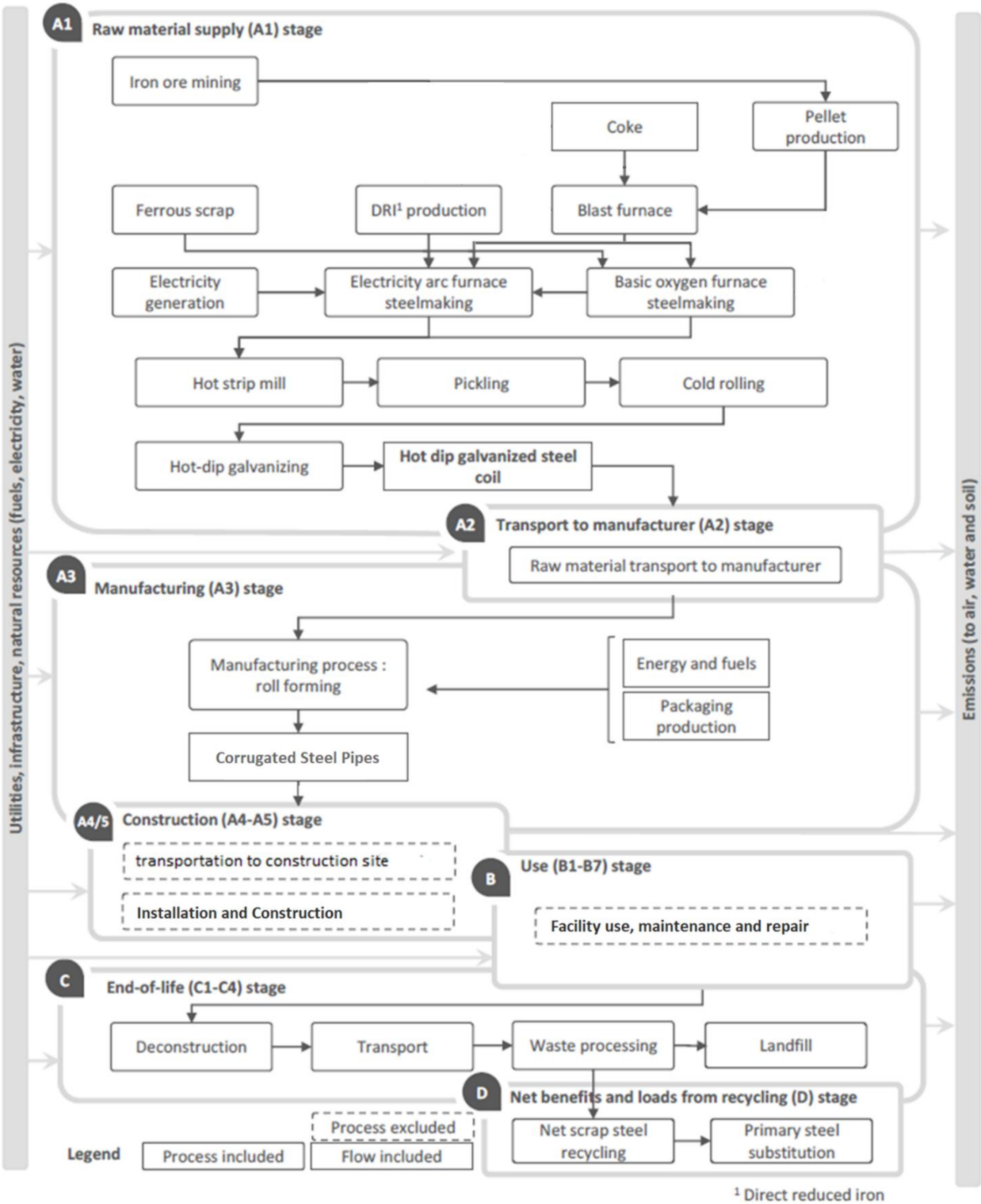

Figure 3. Process flow diagram for corrugated steel pipe production

3.4 LIFE CYCLE STAGES & SYSTEM BOUNDARY

The product stage is included in the cradle-to-gate with options system boundary as shown in Table 4. Note that the reference service life is not specified as the study does not cover life cycle stages for product use. The primary data collected in this study for module A1 represents the cradle to mill gate production of hot dip galvanized coil through the AISI hot dip galvanized coil. The secondary dataset that was used for module A3 is based on a weighted average from the production volume from 9 Corrugated Steel Pipe Institute (CSPI) member manufacturers across Canada.

Table 4. Life cycle stages included in this EPD (in accordance with PCR)

Product			Construction		Use							End-of-Life				Benefits & Loads Beyond the System Boundary
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Raw Material Extraction and Processing	Transport to the Fabricator	Fabrication	Transport	Construction – Installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction demolition	Transport	Waste processing	Disposal	Reuse, recovery, and/or recycling potential
X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	X	X	X	X	X

X = included, MND = module not declared

3.5 CUT OFF CRITERIA

This study complies with the rules defined by Worldsteel's procedure of data inventory as follows:

1. All energetic inputs to the process stages were recorded, including heating fuels, electricity, steam, and compressed air.

2. The sum of the excluded material flows must not exceed 5% of mass, energy, or environmental relevance. However, in reality at least 99.9% of material inputs to each process stage were included, which is in line with the ISO 21930 requirement (<1%).

3. Input scrap does not carry a burden in module A1.

4. ENVIRONMENTAL IMPACTS

This cradle-to-gate with options life cycle assessment is compliant with ISO 14040 and 14044 and the Product Category Rule (PCR) Guidance for Building-Related Products and Services Part B: Designated Steel Construction Product EPD Requirements v.2. Environmental impacts were calculated using the IPCC AR5 and TRACI 2.1 impact assessment methods, thus yielding six environmental impact categories. A description of these impact categories is provided in section 4.5. These six impact categories are globally deemed mature enough to be included in Type III environmental declarations.

4.1 DATA SOURCES AND QUALITY

Primary data were provided by 9 CSPI manufacturers for a full year of operations occurring between January 2022 and December 2022 and were considered reliable overall. Below is the list of 9 CSPI manufacturers across Canada where the primary manufacturing data for module A3 is supplied from:

1. 4005 - 50 Avenue, Thorsby, Alberta
2. 4155 Crozier Road, Armstrong, British Columbia
3. 85 rue de Rotterdam, St-Augustin-de-Desmaures, Quebec
4. 34 South Main Street, Deer Lake, Newfoundland Labrador
5. 3155 Route 935 Dorchester, New Brunswick
6. 109 ave Dalcourt, Louiseville Quebec
7. 640 Waydom Dr, Ayr, Ontario
8. 23646 Industrial Road, Thamesville Ontario
9. 59432 Range Rd 265, Westlock, Alberta

Secondary data collected for raw material supply processes were representative of the North American context and technologies used. LCI data sources were used to create results for each inventory flow relative to the declared unit of one metric ton of corrugated steel pipe. Table 5 presents the main sources of data used for the LCA. The LCA model was developed with Gabi 10.7 software and database.

Table 5: data sources used for the LCA study

Module	Scope	Data Source	Region	Year
A1	Production of Hot Dip Galvanized Coil	AISI	North America	2020
A2	Transportation to Roll Forming operation	Primary Data Collection	Canada	2021
A3	CSP Roll Forming and Fabrication	Primary Data Collection from 9 CSPI manufacturers	Canada	2022
C1	Deconstruction	Gabi 10.7	Global	2021
C2	Transport to Waste Processing	Gabi 10.7	US	2021
C3	Waste Processing	Ecoinvent v 3.8	Global	2022
C4	Disposal of Waste	Gabi 10.7	Europe	2021
D	Credit for end-of-life recycling	Worldsteel	Global	2020
	Other Processes	Gabi 10.7, US LCI database (integrated for Gabi)	varies	varies

Table 6 summarizes the data quality assessment for each module included in the LCA based on the parameters listed in the PCR.

Table 6: data quality assessment for the LCA study

Data quality parameters	Data quality assessment for each module
Time-related coverage	All data are from within the last 10 years with most primary data collected in 2020. Time-related coverage is therefore considered good.
Geographical coverage	All primary data collected for the manufacturers (A2 and A3 stages) were specific to the manufacturing location in Canada. For steel mills (A1 stages), data for hot dip galvanized coil is for North American production. Overall, geographical coverage is good.
Technology coverage	Very recent annual data covering the predominant steelmaking technologies. The AISI dataset includes both EAF and BOF hot dip galvanized coil production routes. Technological representativeness is therefore good.
Reliability	The majority of the relevant foreground data are measured data or calculated based on primary information provided by steel mills (A1 stage) or manufacturers (A2 and A3 stages). Therefore, reliability is considered to be high for A1-A3. Secondary data for end-of-life stages are considered good.
Completeness	For the data collected from the manufacturers (A2 and A3 stages), each parameter was checked in comparison of the weighted average. Manufacturer's data represented annual operations inclusive of seasonal and other normal annual fluctuations in operations. All relevant and specific processes were considered and modeled to represent the specified products. The completeness of the data used for A1-A3 is considered high.
Representativeness	The representativeness is good overall. See time-related, geography and technology coverages parameters above.
Consistency	All primary data were collected with the same level of detail (i.e., using consistent data collection templates), while all background data were sourced from the GaBi and Ecoinvent databases. Allocation and other methodological choices were made consistently throughout the model.
Reproducibility	Reproducibility is supported as much as possible through the disclosure of the weighted average inventory, datasets choices, and modeling approaches in this report.

4.2 ALLOCATION

The allocation method used to create the AISI HDG coil dataset was developed by the World Steel Association and EUROFER to be in line with EN 15804 and ISO 21930:2017. The methodology is based on physical allocation and takes account of the manner in which changes in inputs and outputs affect the production of co-products. The method also takes account of material flows that carry specific inherent properties. This method is deemed to provide the most representative partitioning of the processes involved. Economic allocation was considered, as slag is considered a low-value co-product under EN 15804, however, as neither hot metal nor slag are tradable products upon leaving the blast furnace, economic allocation would most likely be based on estimates. Similarly, BOF slag must undergo processing before being used as a clinker or cement substitute. The Worldsteel and EUROFER /Co-product LCI methodology, 2013/ also highlights that companies purchasing and processing slag work on long-term contracts which do not follow regular market dynamics of supply and demand.

4.3 LIFE CYCLE IMPACT ASSESSMENT - RESULTS

LCIA Results for production of 1 metric ton of CSP are presented in Table 7 to Table 9.

Table 7: Results for environmental impacts for corrugated steel pipe production

Per metric ton of corrugated steel pipe								
Life Cycle Stages	A1	A2	A3	C1	C2	C3	C4	D
GWP - IPCC 2013 (AR5) [kg CO_2 eq.]	2.28 E+003	1.16 E+001	3.89 E+001	6.31 E-001	2.21 E+001	6.56 E-001	1.29 E+000	-2.52 E+002
TRACI 2.1 Impacts								
AP [kg SO_2 eq.]	4.54 E+000	3.28 E-002	2.17 E-001	2.75 E-003	4.54 E-002	2.20 E-003	8.53 E-003	-4.96 E-001
EP [kg N eq.]	2.31 E-001	3.41 E-003	1.61 E-002	2.43 E-004	5.41 E-003	1.58 E-004	7.40 E-004	-2.96 E-002
ODP [kg CFC 11eq.]	2.39 E-012	2.99 E-014	6.71 E-008	1.65 E-015	5.70 E-014	6.68 E-014	2.36 E-011	6.80 E-012
SFP [kg O_3 eq.]	7.89 E+001	7.49 E-001	4.23 E+000	9.23 E-002	1.03 E+000	2.70 E-002	1.64 E-001	-5.35 E+000

Table 8: Results for the resource use of corrugated steel pipe production

Per metric ton of corrugated steel pipe								
Resource use flows	A1	A2	A3	C1	C2	C3	C4	D
NRPRe [MJ]	2.71 E+004	1.63 E+002	1.55 E+003	8.99 E+000	3.11 E+002	1.50 E+001	1.75 E+001	-2.50 E+003
RPRe [MJ]	1.48 E+003	6.49 E+000	3.75 E+002	3.58 E-001	1.24 E+001	1.30 E+001	1.72 E+000	9.88 E+001
NRPRm [MJ]	8.42 E-003	6.40 E-007	3.78 E-006	3.53 E-008	1.22 E-006	2.53 E-008		- 6.40 E-004
RPRm [MJ]	0	0	1.43 E+002	0	0	1.42 E-009	3.98 E-001	3.99 E-008
NRSF [MJ]							6.54 E-002	
RSF [MJ]							3.21 E-002	
RE [MJ]								
FW [m3]	1.02 E-001		7.31 E-002			2.90 E-006	0	0
SM [kg]	3.71 E+002							

For the North American context, hazardous waste is defined by the United States Resource Conservation and Recovery Act legislation (40 CFR 261.33) (Resource Conservation and

Recovery Act, 2014), except in module A3 where the classification of the manufacturer was used. All output flows and waste generated during the manufacturing processes are presented in Table 9).

Table 9: Results for waste and output flows generated for corrugated steel pipe production

Per metric ton of corrugated steel pipe								
Waste and output flows	**A1**	**A2**	**A3**	**C1**	**C2**	**C3**	**C4**	**D**
MR [kg]	6.42 E+001		7.41 E-003			9.92 E+002		
HWD [kg]	9.90 E-004		6.50 E-002					
NHWD [kg]	3.99 E-004		2.55 E-002			8.00 E+001		
HLRW [kg]	1.00 E-003	5.54 E-007	8.36 E-005	3.06 E-008	1.06 E-006	2.91 E-006	3.64 E-007	2.76 E-007
ILLRW [kg]	1.76 E-002	1.01 E-005	1.37 E-003	5.58 E-007	1.93 E-005	4.86 E-005	5.62 E-006	5.20 E-006

Disclaimer: This Environmental Product Declaration (EPD) conforms to ISO 14025, 14040, ISO 14044, and ISO 21930.

Scope of results reported: The PCR requires the reporting of a limited set of LCA metrics; therefore, there may be relevant environmental impacts beyond those disclosed by this EPD. The EPD does not indicate that any environmental or social performance benchmarks are met, nor thresholds exceeded.

Accuracy of results: This EPD has been developed in accordance with the PCR applicable for the identified product following the principles, requirements and guidelines of the ISO 14040, ISO 14044, ISO 14025, and ISO 21930 standards. The results in this EPD are estimations of potential impacts. The accuracy of results in different EPDs may vary as a result of value choices, background data assumptions and quality of data collected.

Comparability: EPDs are not comparative assertions and are either not comparable or have limited comparability when they cover different life cycle stages, are based on different product category rules or are missing relevant environmental impacts. Such comparisons can be inaccurate and could lead to the erroneous selection of materials or products which are higher impact, at least in some impact categories. Any comparison of EPDs shall be subject to the requirements of ISO 21930. For comparison of EPDs which report different module scopes, such that one EPD includes Module D and the other does not, the comparison shall only be made based on Modules A1, A2, and A3. Also, when Module D is included in the EPDs being compared, all EPDs must use the same methodology for calculation of Module D values.

Module D Considerations: The values in Module D include a recognition of the benefits or impacts related to steel recycling which occur at the end of the product's service life. The rate of steel recycling and related processes will evolve over time. The results included in Module D attempt to capture future benefits, or impacts, but are based on a methodology that uses current industry-average data reflecting current processes.

Limitations: For each site contributing data, the country specific (US and Canada for this study) electricity grid mix is used. In this EPD, the roll forming process contributes a small fraction of the overall impacts (less than 2% for GWP). Also, applying the Canadian grid is a conservative approach because 7 out of the 9 manufacturing locations are on the east coast with grids that outperform the Canadian average. The LCI profiles for electricity taken from the GaBi 10.7 database (v 2023.2) quantify the related environmental burden on the basis of the consumption mix analysis for the related cradle-to-gate system. This includes domestic production and the most important imports for a certain region.

Statistical information: was provided in this study for module A3 and GWP impact, although the primary data collection accounted for exceedingly small portion of the overall results. The impact results are dominated by secondary datasets, primarily the production of hot dip galvanized coil. A1 data does not have statistical information. Statistical data on GWP impact is presented in Table 10.

Table 10: Statistical information on GWP impact for CSP manufacturing (module A3)

Flow	Quantities	Value	Unit	Min	Max	Standard Deviation
Carbon dioxide [emissions to air]	Mass	6.38E-02	kg	3.55E-03	1.14E-01	1.21E-02
Carbon monoxide [emissions to air]	Mass	1.87E-04	kg	1.04E-05	3.34E-04	3.5E-05
Nitrogen dioxide [emissions to air]	Mass	1.35E-04	kg	7.51E-06	2.41E-04	2.56E-05

4.4 END OF LIFE RECYCLING

End of life recycling is one of the most important sustainability attributes for the steel industry and it is essential that the benefits associated with recycling at the end of life be recognized. As a result of a global scrap shortage in the industry, all scrap that is recovered at the end life will offset primary BOF steel production which has significant environmental footprint Table 11 shows the assumptions used for end-of-life modeling in this study.

Table 11. End of life assumptions for corrugated steel pipe

Assumption	Value
End of life Recycling rate	92%
Recycled content	37%
Reuse at end of life	0%

4.5 LIFE CYCLE IMPACT ASSESSMENT - INTERPRETATION

Global Warming Potential: The global warming potential indicator is dominated by emissions of CO2 (~90%) at the Blast Furnace and by energy production and use all along the production steps. Methane also contributes to a lower extent (6%) to GWP from coal mining and coke making operations.

Acidification Potential: Sulphur dioxide and nitrogen oxides together contribute most to the acidification potential indicator (90%). They arise primarily from electricity production and transportation.

Eutrophication Potential: The EP for steel products is dominated by emissions to air, which contribute 94% to this impact. The main contributor is nitrogen oxides (90%). Emissions to water that contribute to this impact are from nitrogen containing substances, e.g. nitrate, ammonia.

Ozone Depletion Potential: Ozone layer depletion indicator value is mainly determined by electricity production for high grade zinc refining.

Smog Formation Potential: The smog formation potential for steel products is dominated by carbon monoxide coming from the iron ore preparation process which accounts for over 60% of the contribution to this impact. All other major substances contributing to this impact are Sulphur dioxide and nitrogen oxides.

ADP fossil: This indicator is dominated using natural gas and the use of hard coal at the Blast Furnace. The balance is accounted using crude oil and lignite.

Recovered energy (MJ, net calorific value): Energy recovered from disposal of waste in previous systems, such as energy recovery from combustion of landfill gas or energy recovered from other systems using energy sources.

Renewable/non-renewable primary energy (MJ, net calorific value): This parameter refers to the use of energy from renewable resources (e.g., wind, solar, hydro) and non-renewable resources (e.g., natural gas, coal, petroleum).

Renewable/non-renewable secondary fuels (MJ, net calorific value): Inventory of renewable or non-renewable secondary fuels.

Secondary material (kg): Recycled material used to produce a product (ISO, 2020b)

Use of net freshwater resources (m3): This parameter includes water that is consumed by a system. However, it does not refer to water that is used but returned to the original source (e.g., water for hydroelectric turbines, for cooling or river transportation), or to water lost from a natural system (e.g., due to evaporation of rainwater) (EPD International, 2015).

5. GLOSSARY

5.1 ACRONYMS

ADP-fossil – Abiotic Depletion Potential -fossil
AISI – American Iron and Steel Institute
AP- Acidification Potential
CSPI – Corrugated Steel Pipe Institute
CSA - Canadian Standard Association
EPD - Environmental Product Declaration
EP- Eutrophication Potential
FW- Use of net freshwater resources
GWP- Global Warming Potential
HLRW – High level Radiation Waste
HWD – Hazardous Waste Deposition
ILLRW- Intermediate and Low-Level Radiation Waste
NHWD – Non-Hazardous Waste Deposition
NRPRe - Non-renewable primary resources used as an energy carrier
NRPRm- Non-renewable primary resources with energy content used as material
ISO - International Organization for Standardization
LCA - Life cycle assessment
LCI – Life cycle inventory
ODP- Ozone Depletion potential
RPRe - Renewable primary resources used as energy carrier
RPRm: Renewable primary resources with energy content used as material
PCR - Product Category Rule
SFP- Smog Formation Potential
SM: Secondary Material

6. REFERENCES

1. UL Environment. (2020) Product Category Rule (PCR) Part B: Designated Steel Construction Product EPD requirements. 10010-34, v2.

2. UL Environment (2022) Product Category Rules for Building Related Products and Services – Part A: Life Cycle Assessment Calculation Rules and Report Requirements, V4.0

3. Bare, J. C. Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts (TRACI), Version 2.1 - User's Manual; EPA/600/R-12/554 2012.

4. CSA G401-24, Corrugated Steel Pipe Products, February 20245. Safari F., ArcelorMittal Global R&D, Life Cycle Assessment of Industry-average Corrugated Steel Pipe Background Report, December 2023

5. ISO 14040 : Amd 1 :2020 - Environmental management – Life cycle assessment – Principles and framework

6. ISO 14044 : Amd 1 :2016/Amd 2 :2020 - Environmental management – Life cycle assessment – Requirements and guidelines

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9. Addendum to the North American Product Category Rule for Designated Steel Construction Products, Guidance for Corrugated Steel Pipe, Version 1.0, May 11, 2018

10. LCA Methodology report, AISI (2020).

11. ISO 14025: 2006 - Environmental labels and declarations — Type III environmental declarations — Principles and procedures

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