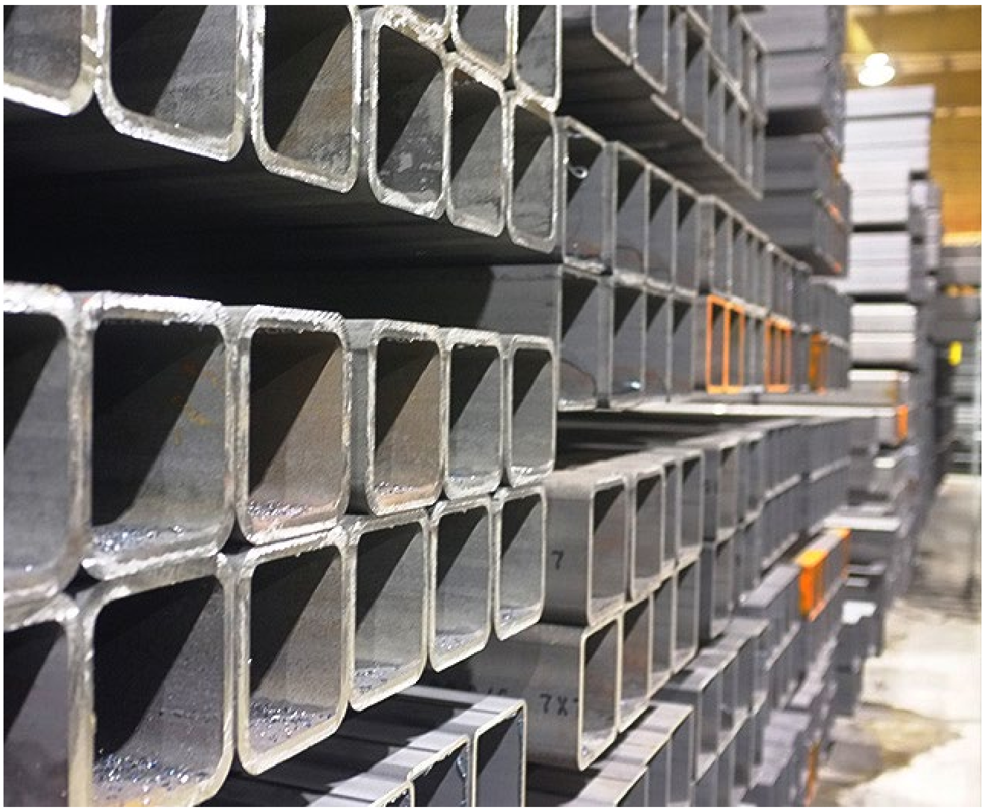
ENVIRONMENTAL PRODUCT DECLARATION

FABRICATED HOLLOW STRUCTURAL SECTIONS

MARUICHI OREGON STEEL TUBE, LLC



MARUICHI OREGON STEEL TUBE, LLC

Maruichi Oregon Steel Tube manufactures the hollow structural sections (HSS) in square and rectangular shapes for a wide variety of applications. They are ideal for use as structural support, safety and ornamental tubing for buildings, bridges and highways, and for an extensive range of applications in industrial, construction, transport and agricultural equipment.

Maruichi Oregon Steel Tube is the northwest's sole producer of structural steel tubing with an annual capacity of up to 150,000 tons. We deliver to a broad regional market, including British Columbia, Alberta, and the western United States.

CERTIFIED
ENVIRONMENTAL PRODUCT DECLARATION
UL.COM/EPD

MARUICHI OREGON STEEL TUBE, LLC

MARUICHI OREGON STEEL TUBE, LLC
FABRICATED HOLLOW STRUCTURAL SECTIONS

According to ISO 14025 and ISO 21930:2017

EPD PROGRAM AND PROGRAM OPERATOR NAME, ADDRESS, LOGO, AND WEBSITE	UL ENVIRONMENT 333 PFINGSTEN ROAD NORTHBROOK, IL 60611 https://www.ul.com https://spot.ul.com
GENERAL PROGRAM INSTRUCTIONS AND VERSION NUMBER	General Program Instructions v.2.5 March 2020
MANUFACTURER NAME AND ADDRESS	Maruichi Oregon Steel Tube, LLC | 8735 N. Harborgate St. Portland, OR 97203
DECLARATION NUMBER	4790026916.101.1
DECLARED PRODUCT & DECLARED UNIT	Fabricated Hollow structural steel sections, 1 metric ton
REFERENCE PCR AND VERSION NUMBER	Part A: Calculation Rules for the LCA and Requirements Project Report, (IBU/UL Environment, V3.2, 12.12.2018) and Part B: Designated Steel Construction Product EPD Requirements (UL Environment, V2.0, 08.26.2020).
DESCRIPTION OF PRODUCT APPLICATION/USE	Fabricated Hollow structural steel sections used in construction
MARKETS OF APPLICABILITY	North America
DATE OF ISSUE	February 3, 2022
PERIOD OF VALIDITY	5 years
EPD TYPE	Product specific
EPD SCOPE	Cradle to gate
YEAR(S) OF REPORTED PRIMARY DATA	2019-2020
LCA SOFTWARE & VERSION NUMBER	GaBi v10
LCI DATABASE(S) & VERSION NUMBER	GaBi 2021 (CUP 2021.2)
LCIA METHODOLOGY & VERSION NUMBER	IPCC AR5 + TRACI 2.1

The sub-category PCR review was conducted by:	UL Environment PCR Review Panel epd@ulenvironment.com
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,", v3.2 (December 2018), in conformance with ISO 21930:2017, serves as the core PCR, with additional considerations from the USGBC/UL Environment Part A Enhancement (2017) ☐ INTERNAL ☒EXTERNAL	Cooper McCollum, UL Environment
This life cycle assessment was conducted in accordance with ISO 14044 and the reference PCR by:	Sphera Solutions Inc
This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by:	James Mellentine, Thrive ESG

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.

MARUICHI OREGON STEEL TUBE, LLC

MARUICHI OREGON STEEL TUBE, LLC
FABRICATED HOLLOW STRUCTURAL SECTIONS

According to ISO 14025 and ISO 21930:2017

General Information

Description of Organization

This environmental product declaration (EPD) represents hollow structural sections (HSS) produced by Maruichi Oregon Steel Tube, LLC (MOST) in Portland, OR, being ISO 9001 certified.

Product Description

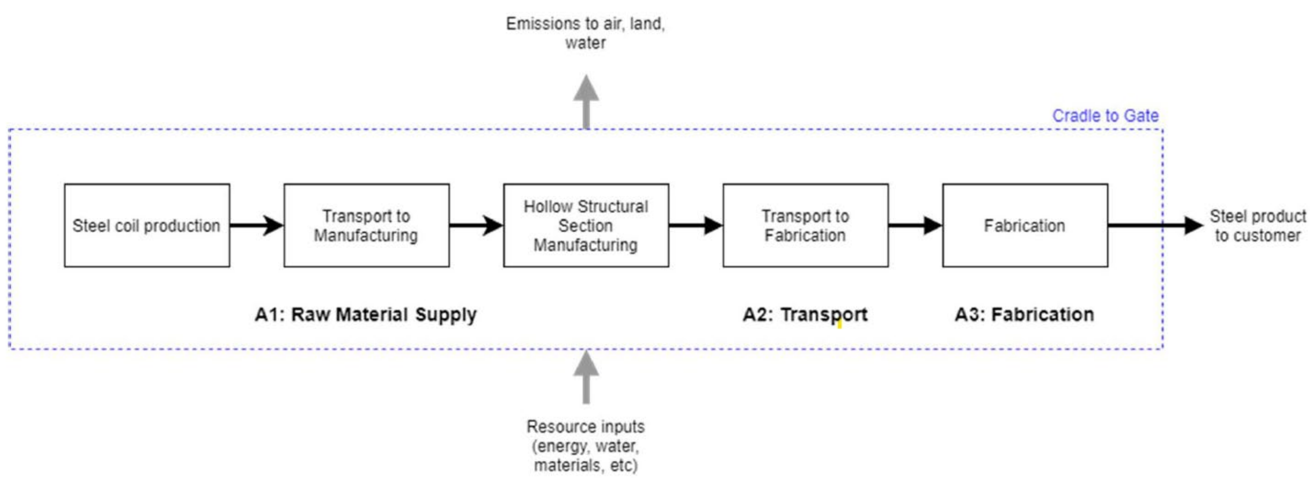
MOST manufactures HSS in square and rectangular shapes for a wide variety of applications. HSS is ideal for use as structural support for buildings, bridges, highways, and for an extensive range of applications in industrial, construction, transport, and agricultural equipment.

Product Specification

HSS products produced by MOST are defined by the following ASTM standards.

- A500B/C
- A1085
- A513

Flow Diagram



Product Average

The 2019 and 2020 production data used in this EPD considers HSS produced by MOST during the year. The products are manufactured in the US/North America. As MOST produces HSS at one location, no product averaging was required.

Application

A513/HSS products are rolled to various lengths/shapes in construction, OEM's for various applications. HSS products are used in bridges, buildings and many other structural applications.

Material Composition

Steel HSS products are made of carbon steel with a small percentage of alloy elements and paints included. The products do not contain any hazardous substances according to the Resource Conservation and Recovery Act (RCRA), Subtitle 3. The products do not release dangerous substances to the environment, including indoor air emissions, gamma or ionizing radiation, or chemicals released to air or leached to water and soil.

Methodological Framework

Declared unit

The declared unit for this EPD is one metric ton of steel construction products. Note that comparison of EPD results on a mass basis alone is insufficient and should consider the technical performance of the product.

Table 1. Declared unit

NAME	VALUE	UNIT
Declared unit	1	metric ton
Density (typical)	7,850	kg/m^3

System Boundary

This EPD is “cradle-to-gate” in scope. The life cycle stages included in the assessment represent the product stage (modules A1-A3).

PRODUCT STAGE			CONSTRUCT-ION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARY
Raw material supply	Transport	Manufacturing	Transport from gate to site	Assembly/Install	Use	Maintenance	Repair	Replacement	Refurbishment	Building Operational Energy Use During Product Use	Building Operational Water Use During Product Use	Deconstruction	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	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND

* X = module included, MND = module not declared

Allocation

No multi-output allocation was required in the foreground system of the study.

Allocation of background data (energy and materials) taken from the GaBi 2021 databases is documented online at http://www.gabi-software.com/america/support/gabi/. Background data for steelmaking from AISI use the system expansion allocation method for co-products from the steelmaking process.

Since the EPD does not cover the end-of-life of the products, end-of-life allocation is outside the scope of the study. Metal scrap from manufacturing (module A3) was balanced with the scrap demand of the raw materials module (A1) in order to calculate the net scrap input to module A1.

Under a cradle-to-gate system boundary, scrap inputs to the system are not associated with any upstream burden, and scrap produced during manufacturing is assumed to be at least the same quality as scrap inputs into steelmaking. Remelting of scrap to produce structural steel and other raw materials is accounted for within module A1 using upstream datasets.

Cut-off Rules

In lieu of arbitrary cut-off criteria, all available energy and material flow data were included in the model for processes within the system boundary.

In cases where no matching life cycle inventories were available to represent a flow, proxy data were applied based on conservative assumptions regarding environmental impacts.

Data Sources

The LCA model was created using the GaBi 10 software system for life cycle engineering, developed by Sphera (Sphera, 2021). Background life cycle inventory data for raw materials and processes were obtained from the GaBi 2021 database (CUP 2021.1). Primary manufacturing data were provided by Maruichi Oregon Steel Tube (MOST). member companies.

Data Quality

A variety of tests and checks were performed by the LCA practitioner throughout the project to ensure high quality of the completed LCA. Checks in cluded an extensive internal review of the project-specific LCA models developed as well as the background data used. A full data quality assessment is documented in the background report.

Period Under Review

Primary data were collected for HSS production during the year 2019 and 2020. Background data for steel coil production was taken from The American Iron and Steel Institute (AISI) and represents steel production during 2017. Fabrication data was taken from The American Institute of Steel Construction (AISC) and represents fabrication activity in 2019 and 2020 (AISI, 2021) (AISC, 2021). This analysis is intended to represent production in 2020.

Estimates and Assumptions

The underlying study was conducted in accordance with the PCR. While this EPD has been developed by industry experts to best represent the product system, real life environmental impacts of HSS products may extend beyond those defined in this document.

All of the raw materials and energy inputs have been modeled using processes and flows that closely follow actual production data on raw materials and processes. All of the reported material and energy flows have been accounted for. The HSS inventory data was collected as part of The Steel Tube Institute (STI) industry-average EPD (STI, 2021). Where inbound transportation data was incomplete, a distance of 500 miles by truck was used.

Proxy data were applied to some materials where no matching life cycle inventories were available, as documented in the background report.

Technical Information and Scenarios

Manufacturing

Hollow structural sections are manufactured by cold-forming steel coil into tubes. Hot-rolled coil is first slit into sections of appropriate width. The narrower coils are then uncoiled and passed through a series of rollers that form the continuous sheet into tubes. Tube cross-sections can be rectangular, round, or elliptical, depending upon the intended application. The two edges of the coil are welded together via an electric resistance welding process and the product is then cut to length. Once manufactured, HSS can be coated—or left uncoated.

The primary input to HSS production is the steel itself, although small amounts of process and coating materials are needed. Electricity is used for manufacturing and to move the materials. Manufacturing produces some metal scrap. The scrap generated during manufacturing is assumed to be produced at the same quality as used by the upstream metal production processes. Therefore, the scrap from manufacturing is treated assuming open-loop recycling.

Fabrication results are taken from the American Institute of Steel Construction (AISC) industry average EPD (AISC, 2021).

Inbound Transportation

Inbound transportation distances and modes for steel and process materials were collected from the site.

Transportation

Transportation to the customer or construction site is outside the scope of this EPD. Transportation (A2) from the HSS producers to the fabricator is included in the analysis and in this report.

Product Installation

This EPD includes fabrication impacts, however, installation (erection) is outside the scope of this EPD.

Use

Product use is outside the scope of this EPD.

Reuse, Recycling, and Energy Recovery

Product reuse, recycling, and incineration for energy recovery is outside the scope of this EPD.

Disposal

Product disposal is outside the scope of this EPD.

Environmental Indicators Derived from LCA

North American life cycle impact assessment (LCIA) results are declared using TRACI 2.1 (Bare, 2012; EPA, 2012) methodology, with the exception of GWP which is reported using the IPCC AR5 (IPCC, 2013) methodology, excluding biogenic carbon. Primary energy use represents the lower heating value (LHV) a.k.a. net calorific value (NCV).

LCIA results are relative expressions and do not predict actual impacts, the exceeding of thresholds, safety margins or risks.

Fabrication requires 1.08 metric tons of HSS per 1 metric ton of fabricated product (AISC, 2021). A1 includes production of all 1.08 metric tons of HSS, A2 represent transportation to the fabrication facility and A3 represents the fabrication activities.

Table 2. LCIA results, per 1 metric ton of fabricated HSS

PARAMETER	UNIT	TOTAL	A1	A2	A3
GWP 100	kg CO_2 eq.	**1.75E+03**	1.61E+03	4.46E+01	9.67E+01
ODP*	kg CFC 11 eq.	**1.62E-09**	-1.85E-12	8.67E-14	1.62E-09
AP	kg SO_2 eq.	**3.88E+00**	3.55E+00	1.83E-01	1.52E-01
EP	kg N eq.	**2.10E-01**	1.81E-01	1.64E-02	1.23E-02
SFP	kg O_3 eq.	**6.88E+01**	6.21E+01	4.44E+00	2.23E+00
ADP_{fossil}	MJ surplus	**1.54E+03**	1.36E+03	7.16E+01	1.04E+02

* ODP has limited relevance due to the absence of ozone-depleting emissions in the LCI, in both the background and foreground data.

Comparability: Comparisons cannot be made between product-specific or industry average EPDs at the design stage of a project before a building has been specified. Comparisons may be made between product-specific or industry average EPDs at the time of product purchase when product performance and specifications have been established and serve as a functional unit for comparison. Environmental impact results shall be converted to a functional unit basis before any comparison is attempted.

Any comparison of EPDs shall be subject to the requirements of ISO 21930. EPDs are not comparative assertions and are either not comparable or have limited comparability when they have different system boundaries, are based on different product category rules or are missing relevant environmental impacts. Such comparison can be inaccurate, and could lead to erroneous selection of materials or products which are higher-impact, at least in some impact categories.

Table 3. Resource use results, per 1 metric ton of fabricated HSS

PARAMETER	UNIT	TOTAL	A1	A2	A3
RPR_E	MJ LHV	**1.43E+03**	1.15E+03	6.24E+01	2.16E+02
RPR_M	MJ LHV	**-**	-	-	-
$NRPR_E$	MJ LHV	**2.25E+04**	2.03E+04	6.91E+02	1.47E+03

MARUICHI OREGON STEEL TUBE, LLC

MARUICHI OREGON STEEL TUBE, LLC
FABRICATED HOLLOW STRUCTURAL SECTIONS

According to ISO 14025 and ISO 21930:2017

$NRPR_M$	MJ LHV	**1.27E+01**	1.49E-01	-	1.26E+01
SM	kg	**4.65E+02**	4.64E+02	-	7.52E-01
RSF	MJ LHV	**-**	-	-	-
NRSF	MJ LHV	**-**	-	-	-
RE	MJ LHV	**-**	-	-	-
FW	m^3	**9.62E+00**	8.76E+00	1.81E-01	6.82E-01

Table 4. Output flows and waste categories results, per 1 metric ton of fabricated HSS

PARAMETER	UNIT	TOTAL	A1	A2	A3
HWD	kg	**1.70E+00**	1.36E+00	-	3.32E-01
NHWD	kg	**3.82E+01**	2.85E+01	-	9.66E+00
HLRW	kg	**1.54E-03**	1.39E-03	3.16E-05	1.18E-04
ILLRW	kg	**1.29E+00**	1.17E+00	2.64E-02	9.85E-02
CRU	kg	**-**	-	-	-
MFR	kg	**2.44E+02**	1.67E+02	-	7.71E+01
MER	kg	**-**	-	-	-
EE	MJ LHV	**-**	-	-	-

Maruichi Oregon Steel Tube LLC produces HSS in one location only. The GWP for the cradle-to-gate mill / unfabricated product is 1.62E+03 kg CO_2.

Visualization of Life Cycle Impact Assessment

The relative contribution of each life cycle stage to the overall cradle-to-gate impact are presented in Figure 1.

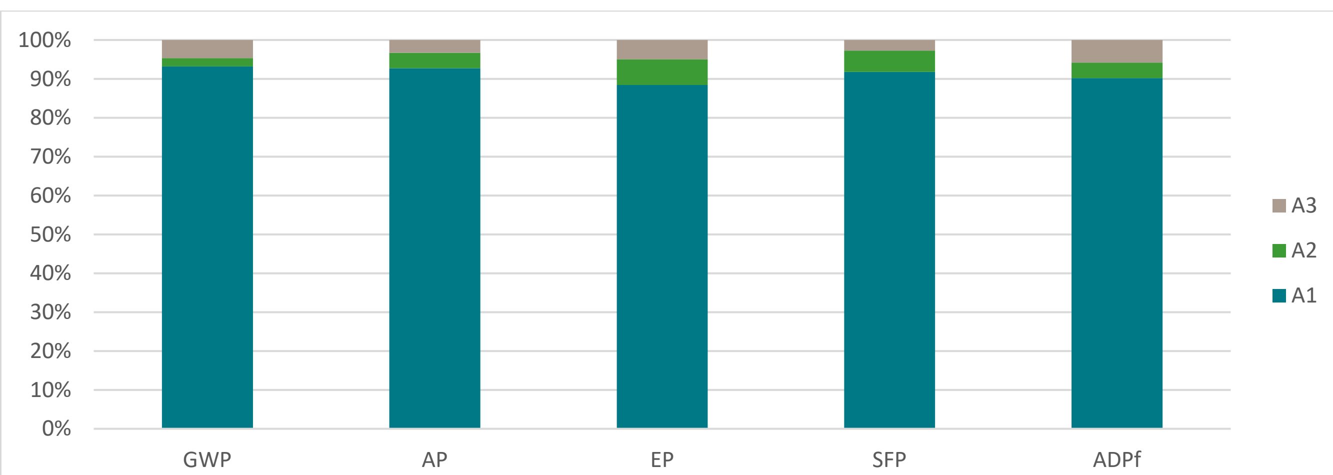


Figure 1: Relative contribution by life cycle stage for 1 metric ton of fabricated HSS

MARUICHI OREGON STEEL TUBE, LLC

MARUICHI OREGON STEEL TUBE, LLC
FABRICATED HOLLOW STRUCTURAL SECTIONS

According to ISO 14025 and ISO 21930:2017

The vast majority of potential environmental impacts is driven by the upstream burdens of steelmaking, therefore A1 is the dominant contributor across LCIA indicators.

To better understand sources of potential environmental impacts in MOST's HSS manufacturing process, Figure 2 presents relative results for HSS manufacturing (A1 only). Potential environmental impacts for HSS manufacturing are dominated by upstream burdens of steelmaking.

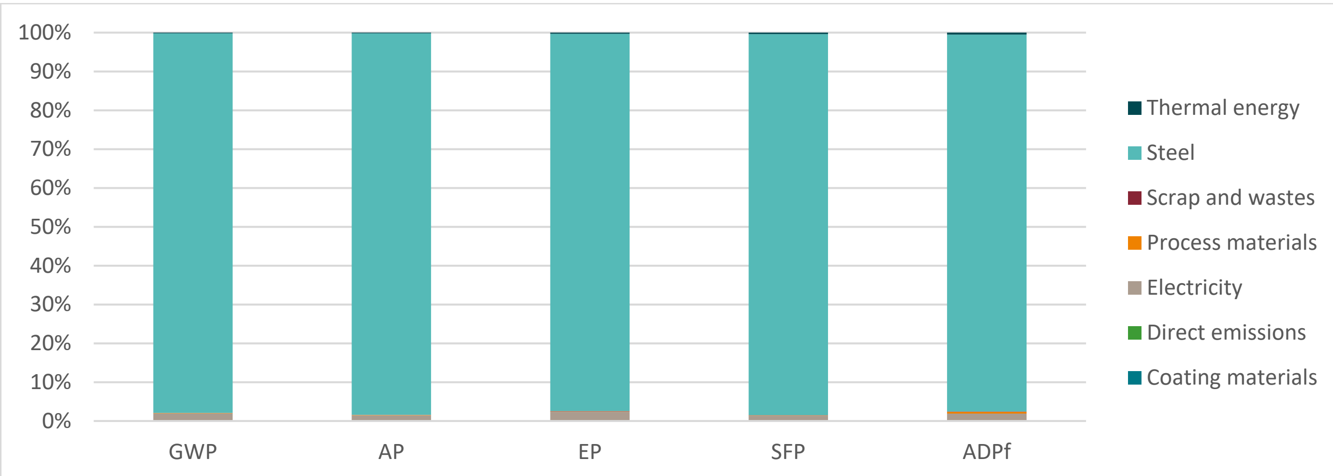


Figure 2: Relative contribution by manufacturing component for 1 metric ton of unfabricated HSS

Interpretation

The cradle-to-gate potential environmental impacts of MOST's fabricated HSS products are driven by steel coil production (A1).

Additional Environmental Information

Environment and Health During Manufacturing

The steel products, under normal conditions, do not present an inhalation, ingestion or skin hazard. However, operations such as welding, grinding, sawing and burning which may cause airborne particulates or fume formation, may present a health hazard. Company has installed the local exhaust ventilations near the source to minimize airborne concentrations.

Further Information

For further information, visit http://most.us.com.

References

AISC. (2021). *Environmental Product Declaration: Fabricated Hot-Rolled Structural Sections.* UL Environment. Retrieved from https://www.aisc.org/globalassets/why-steel/epd-aisc-hr-sections-2021.pdf

AISI. (2021). *Facts about American Steel Sustainability.* Retrieved from https://www.steel.org/wp-content/uploads/2021/11/AISI_FactSheet_SteelSustainability-11-3-21.pdf2021%2F11%2FAISI_FactSheet_SteelSustainability-11-3-21.pdf&clen=889481&chunk=true

Bare, J. (2012). *Tool for the Reduction and Assessment of Chemical and other Environmental Impacts (TRACI) - Software Name and Version Number: TRACI version 2.1 - User's Manual.* Washington, D.C.: U.S. EPA.

EPA. (2012). *Tool for the Reduction and Assessment of Chemical and other Environmental Impacts (TRACI) - User's Manual.* Washington, D.C.: US EPA.

IPCC. (2013). *Climate Change 2013: The Physical Science Basis.* Genf, Schweiz: IPCC.

ISO. (2006). *ISO 14040/Amd.1:2020: Environmental management – Life cycle assessment – Principles and framework.* Geneva: International Organization for Standardization.

ISO. (2006). *ISO 14044:2006/Amd.1:2017/Amd.2:2020 Environmental management – Life cycle assessment – Requirements and guidelines.* Geneva: International Organization for Standardization.

ISO. (2017). *ISO 21930: Sustainability in buildings and civil engineering works -- Core rules for environmental product declarations of construction products and services.* Geneva: International Organization for Standardization.

Sphera. (2021). *GaBi LCA Database Documentation*. Retrieved from Sphera Solutions, Inc.: http://www.gabi-software.com/america/support/gabi/

STI. (2021). *Steel Tube Institute.* Retrieved from https://steeltubeinstitute.org/wp-content/uploads/2021/09/7.31.21-STI_Industry-Wide-EPD_Hollow-Structural-Steel-Sections.pdf

UL Environment. (2018). *Part A: Life Cycle Assessment Calculation Rules and Report Requirements, Version 3.2.*

UL Environment. (2020). *Part B: Designated Steel Construction Product EPD Requirements.*

UL Environment. (2020). *Program Operator Rules v 2.5.*

Contact Information

Study Commissioner

MARUICHI OREGON STEEL TUBE, LLC

Maruichi Oregon Steel Tube, LLC
8735 N. Harborgate St.
Portland, OR 97203
http://most.us.com

LCA Practitioner

sphera™

Sphera Solutions, Inc.
130 E Randolph St, #2900
Chicago, IL 60601
https://sphera.com/contact-us/
www.sphera.com