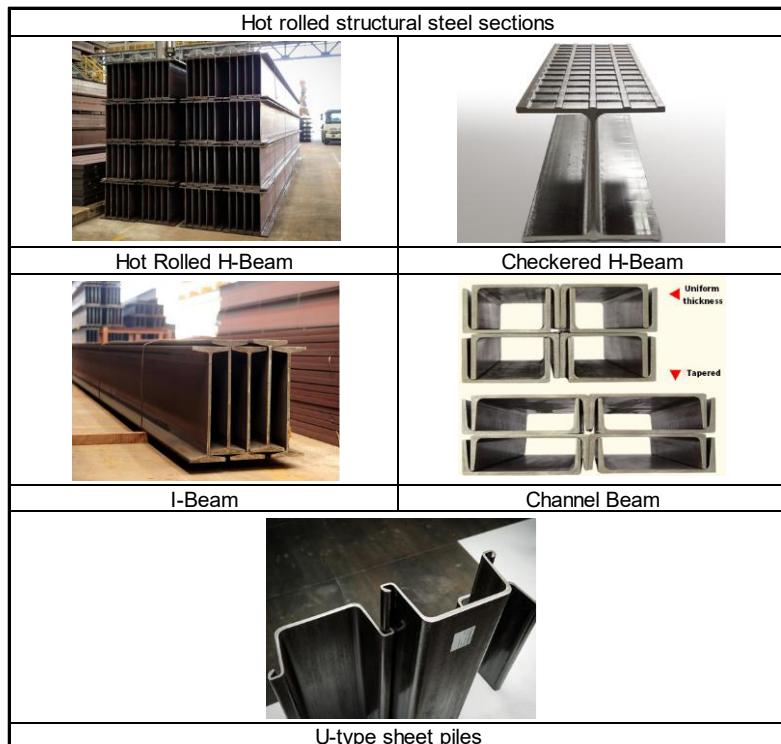


ENVIRONMENTAL PRODUCT DECLARATION

HOT ROLLED STRUCTURAL STEEL SECTIONS



Hot rolled structural steel sections include “Hot Rolled H-Beam”, “Checkered H-Beam”, “Channel Beam” and “U-type sheet piles”.

TUNG HO STEEL ENTERPRISE CORP.

From its beginnings in “Tung Ho Hang” to today's Tung Ho Steel Enterprise Corporation, the company has always made trustworthiness the company's spiritual essence in its business. The company's core business values and objectives are embodied in the pursuit of exceptional contributions to society.

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In response to global warming, in order to effectively mitigate the impacts of climate change, Tung Ho Steel is actively promoting energy conservation and CO₂ reductions, as well as proactively disclosing the carbon footprint information for its products.

Through product carbon footprint inventory, it is possible to learn about the greenhouse gas emissions throughout a product's lifecycle. This enables effective problem identification and implementation of low-carbon and energy-conserving design philosophies to increase service competitiveness.



ENVIRONMENTAL PRODUCT DECLARATION

 **TUNG HO STEEL ENTERPRISE CORP.**



HOT ROLLED STRUCTURAL STEEL SECTIONS

According to ISO 14025,
EN 15804 + A2

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	PROGRAM OPERATOR RULES V2.7 2022
MANUFACTURER NAME AND ADDRESS	"TUNG HO STEEL ENTERPRISE CORP. Headquarter 6F., No.9, Sec. 1, Chang-an E. Rd., Taipei City 10441, Taiwan https://www.tunghosteel.com/EN/HomeEg/Index Site for which this EPD is representative: Miaoli Works Address: No. 22, Pingding, Erhu Vil., Xihu Township, Miaoli County 36842, Taiwan Contact person: K. U. Wu h82wku@tunghosteel.com "
DECLARATION NUMBER	4791791174.101.1
DECLARED PRODUCT & FUNCTIONAL UNIT OR DECLARED UNIT	HOT ROLLED STRUCTURAL STEEL SECTIONS Declared Unit: 1 metric ton
REFERENCE PCR AND VERSION NUMBER	Construction Products PCR 2019:14 version 2.0.1
DESCRIPTION OF PRODUCT APPLICATION/USE	"Hot rolled structural steel sections include "Hot Rolled H-Beam", "Checkered H-Beam", "I-Beam", "Channel Beam" and "U-type sheet piles". *Hot Rolled H-Beam is broadly applied in large-scale buildings with major load-bearing capabilities and stable cross-section performance, as well as in bridges, ships, cranes, equipment foundations, support frames, and foundation piles. *Checkered H-Beam is suitable for cover plates involving applications in temporary steel bridges, rapid transit, and other civil engineering projects. *I-Beam is broadly applied in industrial buildings and metal structures such as factories, bridges, ships, agricultural vehicle manufacturing, and power transmission towers. *Channel beam is widely applied in building structure and vehicle production, as well as other industrial structures. *U-type sheet piles are broadly used in retaining walls, piers, dams and levees, and other projects."
PRODUCT RSL DESCRIPTION (IF APPL.)	-
MARKETS OF APPLICABILITY	Local and international
DATE OF ISSUE	December 19, 2025
PERIOD OF VALIDITY	December 19, 2030
EPD TYPE	Product-specific
RANGE OF DATASET VARIABILITY	Mean
EPD SCOPE	Cradle to gate
YEAR(S) OF REPORTED PRIMARY DATA	2024
LCA SOFTWARE & VERSION NUMBER	SimaPro 10.2.0.0
LCI DATABASE(S) & VERSION NUMBER	Ecoinvent 3 & EF database 3.1 & EF Database 2.0 & Ecoinvent unit processes & Ecoinvent system processes & USLCI+ & LCA Database
LCIA METHODOLOGY & VERSION NUMBER	EN 15804 + A2 (adapted) V1.03/ EDIP 2003 V1.07/ AWARE V1.07/ Cumulative Exergy Demand V1.09

The PCR review was conducted by:

The International EPD System

LCA-lab srl, SAPI srl

info@environdec.com

This declaration was independently verified in accordance with ISO 14025: 2006.

INTERNAL

EXTERNAL

Skye Tang, UL Solutions



ENVIRONMENTAL PRODUCT DECLARATION

 **TUNG HO STEEL ENTERPRISE CORP.**



HOT ROLLED STRUCTURAL STEEL SECTIONS

According to ISO 14025,
EN 15804 + A2

This life cycle assessment was conducted in accordance with ISO 14044 and the reference PCR by:

C.C.Sustain ESG Solution Co., Ltd.

This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by:

Ik-Kim, Smart-Eco



LIMITATIONS

Exclusions: EPDs do not indicate that any environmental or social performance benchmarks are met, and there may be impacts that they do not encompass. LCAs do not typically address the site-specific environmental impacts of raw material extraction, nor are they meant to assess human health toxicity. EPDs can complement but cannot replace tools and certifications that are designed to address these impacts and/or set performance thresholds – e.g. Type 1 certifications, health assessments and declarations, environmental impact assessments, etc.

Accuracy of Results: EPDs regularly rely on estimations of impacts; the level of accuracy in estimation of effect differs for any particular product line and reported impact.

Comparability: EPDs from different programs may not be comparable. Full conformance with a PCR allows EPD comparability only when all stages of a life cycle have been considered. However, variations and deviations are possible". Example of variations: Different LCA software and background LCI datasets may lead to differences results for upstream or downstream of the life cycle stages declared.

ENVIRONMENTAL PRODUCT DECLARATION



HOT ROLLED STRUCTURAL STEEL SECTIONS

According to ISO 14025,
EN 15804 + A2

1. Product Definition and Information

1.1. Description of Company/Organization

From its beginnings in "Tung Ho Hang" to today's Tung Ho Steel Enterprise Corporation, the company has always made trustworthiness the company's spiritual essence in its business. The company's core business values and objectives are embodied in the pursuit of exceptional contributions to society.

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1.2. Product Description

Product Identification

"Hot rolled structural steel sections include "Hot Rolled H-Beam", "Checkered H-Beam", "I-Beam", "Channel Beam" and "U-type sheet piles".

Manufacturing

The manufacturing process includes two major parts, the first is electric arc furnace steelmaking process, and the second is hot rolling process. The quality management system is ISO 90001. The environmental management system is ISO 14001.

Environment



ENVIRONMENTAL PRODUCT DECLARATION

TUNG HO STEEL ENTERPRISE CORP.



HOT ROLLED STRUCTURAL STEEL SECTIONS

According to ISO 14025,
EN 15804 + A2

The occupational safety management system is ISO 45001.

Flow Diagram

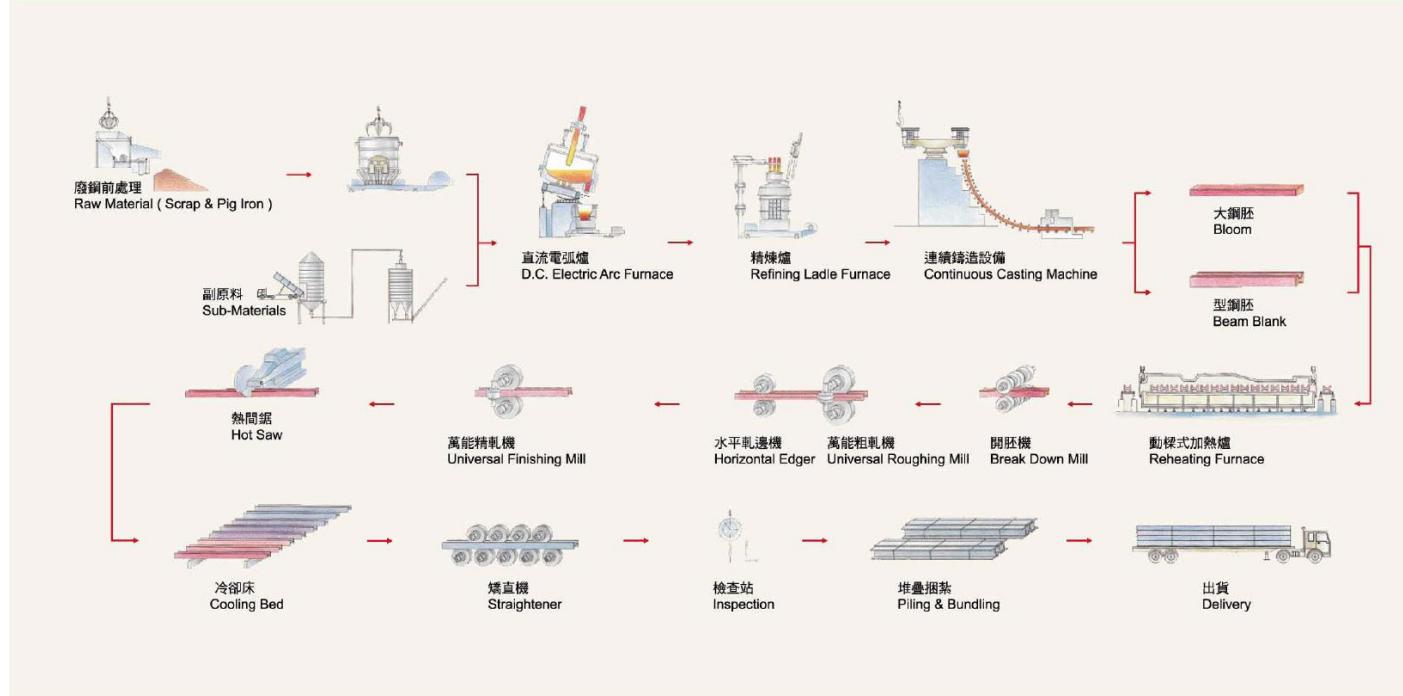


Figure 1. Flow diagram of Hot rolled structural steel sections manufacturing process

1.3. Application

Hot Rolled H-Beam is broadly applied in large-scale buildings with major load-bearing capabilities and stable cross-section performance, as well as in bridges, ships, cranes, equipment foundations, support frames, and foundation piles.

Checkered H-Beam is suitable for cover plates involving applications in temporary steel bridges, rapid transit, and other civil engineering projects.

I-Beam is broadly applied in industrial buildings and metal structures such as factories, bridges, ships, agricultural vehicle manufacturing, and power transmission towers.

U-type sheet piles are broadly used in retaining walls, piers, dams and levees, and other projects.

ENVIRONMENTAL PRODUCT DECLARATION



HOT ROLLED STRUCTURAL STEEL SECTIONS

According to ISO 14025,
EN 15804 + A2

1.4. Declaration of Methodological Framework

The Environmental Product Declaration (EPD) analysis is based on a cradle-to-gate system boundary, covering the life cycle stages from raw material extraction up to the factory gate, including production and transportation to the gate.

Given the structural function of the declared products, the use phase and end-of-life stages are excluded from the scope of this assessment.

Additional details regarding assumptions, cut-off criteria, and allocation procedures can be found in Sections 2.3, 2.4, and 2.8, respectively.

1.5. Technical Requirements

Product Specification

The products own CE MARK for LRV, and can be customized in accordance with Chinese National Standard(CNS), Australian Standard(AS), Japanese Industrial Standard(JIS), European Standard(EN), British Standard(BS) and American Society for Testing and Materials Standard(ASTM). For more details of technical specifications such as: dimensions, properties and steel grade of steel sections, please visit:

<https://www.tunghosteel.com/EN/HomeEg/Product/Intro/2>

Table 1. Technical Data

NAME	VALUE	UNIT
Density	7,850	kg/m ³
Modulus of elasticity	2.1	N/mm ²
Coefficient of thermal expansion	11.6	10 ⁻⁵ /°C
Thermal conductivity	80.2	W/(mK)
Melting point	1,493	°C
Electrical conductivity at 20°C	1,030	Ω ⁻¹ m ⁻¹
Minimum yield strength (für low carbon steel)	345	N/mm ²
Minimum tensile strength (für low carbon steel)	450	N/mm ²
Minimum elongation (für Bleche)	≥18	%
Tensile strength	≥450	N/mm ²

1.6. Properties of Declared Product as Delivered

The products are bundled with wire for shipment and sold to distributors for delivery.

1.7. Material Composition

The hot rolled structural steel sections manufactured by Tung Ho is made of 100% low alloyed steel manufactured in electric arc furnace with 90% of recycled material.

ENVIRONMENTAL PRODUCT DECLARATION



HOT ROLLED STRUCTURAL STEEL SECTIONS

According to ISO 14025,
EN 15804 + A2

The typical composition of the low alloyed is presented in Table 2.

Table 2. The composition of the low alloyed

ELEMENT	TYPICAL CONTENT
Iron	98.35%
Carbon	0.12%
Manganese	0.78%
Silicon	0.20%
Phosphorus	0.01%
Sulfur	0.01%
Copper	0.25%
Others(Sn, V, Nb, Al, B, Ni, Cr, Mo, Ti)	0.28%
Total	100%

The products do not contain any hazardous substances listed in the “Candidate List of Substances of Very High Concern for Authorisation” (SVHC) exceeding 0.1% of the weight of the product.

1.8. Manufacturing

The steel structure site production flow is: Receiving steel plate materials → Assembly → Welding → Wing plate leveling → Welding bead rectification → Heat shaping → Inspection → Entry into warehouse.

1.9. Packaging

The hot rolled structural steel sections are packaged by rod-carbon steel for delivery.

1.10. Transportation

The materials are delivered to the Tung Ho Steel Enterprise Corporation Miaoli Works's fabrication facility via land, ship, and air are accounted for in the model. Transportation distance to Tung Ho Steel Enterprise Corporation Miaoli Works is calculated separately based on the supplier location.

1.11. Product Installation

This inventory calculation covers stages A1 to A3, and the scope of the inventory does not include Product Installation.

1.12. Use

This inventory calculation covers stages A1 to A3, and the scope of the inventory does not include Use.

1.13. Reference Service Life and Estimated Building Service Life

This inventory calculation covers stages A1 to A3, and the scope of the inventory does not include Reference Service

ENVIRONMENTAL PRODUCT DECLARATION



HOT ROLLED STRUCTURAL STEEL SECTIONS

According to ISO 14025,
EN 15804 + A2

Life and Estimated Building Service Life.

1.14. Reuse, Recycling, and Energy Recovery

Hot rolled structural steel sections is easy to recycling, but it is not suggested to be re-used as structural elements.

1.15. Disposal

The European Waste Index code for hot rolled structural steel sections is ewc-code-17-04-05 – iron and steel.

2. Life Cycle Assessment Background Information

2.1. Functional or Declared Unit

Table 3. Declared Unit: 1 metric ton of HOT ROLLED STRUCTURAL STEEL SECTIONS

NAME	VALUE	UNIT
Declared unit	1	t
Thickness (des Bleches)	please visit: https://www.tunghosteel.com/EN/HomeEg/Product/Intro/2	mm
Density	7,850	kg/m3
Conversion factor to 1 kg	1,000	-

2.2. System Boundary

This is a cradle to gate EPD. The following life cycle stages were considered:

A1 – Raw material supply.

A2 – Transport.

A3 – Manufacturing.

*Not including “CONSTRUCTION PROCESS STAGE”, “USE STAGE” and “END OF LIFE STAGE”.

2.3. Estimates and Assumptions

*The most representative overseas scrap yard is in Long Beach, USA, is assumed all scrap yards operate in the same way.

*The most representative local scrap yard is Hongtian, is assumed all scrap yards operate in the same way.

2.4. Cut-off Criteria

Life Cycle Inventory data for 100% of total inflows (mass and energy) to the upstream and core module have been included. Company infrastructure, employee's transportation and administrative activities were kept out of the scope of this study.

2.5. Data Sources

ENVIRONMENTAL PRODUCT DECLARATION

 **TUNG HO STEEL ENTERPRISE CORP.**



HOT ROLLED STRUCTURAL STEEL SECTIONS

According to ISO 14025,
EN 15804 + A2

The material, energy, transportation, waste treatment and air emission data collected are from the year 2024, and the major data source is from the ERP system of Miaoli Works. The LCA software used for this study is SimaPro 10.2.0.0, the LCI databases include Ecoinvent & U.S. LCI Database.

2.6. Data Quality

The collected data were checked for plausibility and consistency. Good data quality can be assumed. Data quality assessment per information module is provided in Tables 4, 5 and 6.

Table 4. Raw material supply module data quality assessment

DATA	TIME RELATED COVERAGE	GEOGRAPHICAL COVERAGE	TECHNOLOGICAL COVERAGE	DATA SOURCE	MEASURED OR ESTIMATED
Raw materials consumption	2024	Taiwan	Modern	Tung Ho	M
Distance of scrap transportation to recycling center	2024	Taiwan	Modern	Tung Ho	M
Energy and materials consumption of scrap processing in recycling center, as well as waste and generated emissions	2024	Taiwan	Modern	Tung Ho	M
Fuels consumption and emissions related to electricity generation and distribution in Taiwan	2024	Taiwan	Modern	Tung Ho	M&E
Energy consumption and generation of emissions related to natural gas production in Taiwan	2024	Taiwan	Modern	Tung Ho	M&E
Energy and materials consumption to raw materials production for the steelworks	2024	Taiwan	Modern	Tung Ho	M&E

Table 5. Transportation module data quality assessment

DATA	TIME RELATED COVERAGE	GEOGRAPHICAL COVERAGE	TECHNOLOGICAL COVERAGE	DATA SOURCE	MEASURED OR ESTIMATED
Distance of scrap and others raw materials transportation	2024	Taiwan	Not Applicable	Tung Ho	M
Distance of auxiliary items transportation	2024	Taiwan	Not Applicable	Tung Ho	M
Distance of natural gas transportation	2024	Taiwan	Not Applicable	Tung Ho	M
Consumption of materials and energy and emissions related to the transport requirements of raw materials and auxiliary inputs	2024	Taiwan	World average	Ecoinvent	M&E

Table 6. Manufacture module data quality assessment



ENVIRONMENTAL PRODUCT DECLARATION



HOT ROLLED STRUCTURAL STEEL SECTIONS

According to ISO 14025,
EN 15804 + A2

Data	Time Related Coverage	Geographical Coverage	Technological Coverage	Data Source	Measured or Estimated
Production efficiency and generation of by-products	2024	Taiwan	Modern	Tung Ho	M
Consumption of auxiliary items	2024	Taiwan	Modern	Tung Ho	M&E
Energy and materials consumption of auxiliary items production	2024	Taiwan	Modern	Tung Ho	M&E
Waste generation	2024	Taiwan	Modern	Tung Ho	M
Waste treatment process	2024	Taiwan	Modern	Tung Ho	M&E
Air emissions and waste water generation	2024	Taiwan	Modern	Tung Ho	M&E
Distance of waste transportation	2024	Taiwan	Modern	Tung Ho	M&E
Requirements of waste transportation	2024	Taiwan	Modern	Tung Ho	M&E

2.7. Period under Review

From January 1st to December 31st, 2024.

2.8. Allocation

There are no credits from recycling or energy recovery of packaging materials and production waste. On the other hand, this is a "cradle to gate" study, so there are no credits from recycling or energy recovery from the end of life of the product.

Table 7. Allocation

NUMBER	APPLICATION PRODUCTS	ALLOCATION PROPORTIONAL	ALLOCATION PROPORTIONAL(CALCULATED VALUE)	DISTRIBUTION METHOD	ALLOCATION PRINCIPLES DESCRIPTION
Allocation Principle 1	Hot rolled structural steel sections、Hot rolled structural steel plates	0.00000021551937706490%	0.00000000215519377065	1/(Total production of Hot rolled structural steel sections+Total production of Hot rolled structural steel plates)	Shared across the entire plant
	Hot rolled structural steel sections、Hot rolled structural steel plates	0.00000000000000000000%	0.00000000000000000000	0	
Allocation Principle 2	Hot rolled structural steel sections	0.00000027753635815100%	0.00000000277536358151	1/Total production of Hot rolled structural steel sections	All for Hot rolled structural steel sections use
Allocation Principle 4	Hot rolled structural steel plates	0.00000096448524217020%	0.00000000964485242170	1/Total production of Hot rolled structural steel plates	All for Hot rolled structural steel plates use



ENVIRONMENTAL PRODUCT DECLARATION

TUNG HO STEEL ENTERPRISE CORP.



HOT ROLLED STRUCTURAL STEEL SECTIONS

According to ISO 14025,
EN 15804 + A2

Allocation Principle 5	Hot rolled structural steel sections	0.00000022376256082840%	0.00000000223762560828	(Usage of Hot rolled structural steel sections billets/Total production of steelmaking)/Total production of Hot rolled structural steel sections	Steelmaking specific (Hot rolled structural steel sections)
Allocation Principle 6	Hot rolled structural steel plates	0.00000015555153705500%	0.00000000155551537055	(Usage of Hot rolled structural steel plates billets/Total production of steelmaking)/Total production of Hot rolled structural steel plates	Steelmaking specific (Hot rolled structural steel plates)
Allocation Principle 7	Hot rolled structural steel sections · Hot rolled structural steel plates	0.00000008629552384010%	0.00000000086295523840	1/(Total production of steelmaking+Total production of rolling mill+Total production of BH area)	Shared across the entire site (manufacturing stage)

3. Life Cycle Assessment Results

Table 8. Description of the system boundary modules

	PRODUCT STAGE			CONSTRUCT-ION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARY
	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
EPD Type	X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	Deconstruction	Transport	Waste processing	Disposal	Reuse, Recovery, Recycling Potential

(X = included in LCA; MND = Module Not Declared).

3.1. Life Cycle Impact Assessment Results

Table 9. Impact Assessment Results

Environment



ENVIRONMENTAL PRODUCT DECLARATION

TUNG HO STEEL ENTERPRISE CORP.



HOT ROLLED STRUCTURAL STEEL SECTIONS

According to ISO 14025,
EN 15804 + A2

EN15804 V1.03	UNIT (PER TON)	A1	A2	A3	TOTAL A1-A3
Global warming potential - total (GWP-total)	kg CO2 eq.	3.77E+02	7.07E+01	3.70E+02	8.17E+02
Global warming potential - fossil fuels (GWP-fossil)	kg CO2 eq.	3.73E+02	7.06E+01	2.83E+02	7.26E+02
Global warming potential - biogenic (GWP-biogenic)	kg CO2 eq.	3.41E+00	8.24E-02	-4.75E-01	3.02E+00
Global warming potential - land use and land use change (GWP-luluc)	kg CO2 eq.	2.29E-01	4.23E-02	2.50E-01	5.21E-01
Depletion potential of the stratospheric ozone layer (ODP)	kg CFC-11 eq.	3.07E-06	6.11E-08	1.46E-07	3.28E-06
Acidification potential, accumulated exceedance (AP)	mol H+ eq.	2.32E+00	1.70E+00	1.17E+00	5.19E+00
Eutrophication potential - freshwater (EP-freshwater)	kg P eq.	1.58E-01	2.99E-03	2.13E-01	3.74E-01
Eutrophication potential - marine (EP-marine)	kg N eq.	4.28E-01	4.15E-01	2.55E-01	1.10E+00
Eutrophication potential - terrestrial (EP-terrestrial)	mol N eq.	4.40E+00	4.62E+00	2.28E+00	1.13E+01
Photochemical ozone creation potential (POCP)	kg NMVOC eq.	1.35E+00	1.21E+00	6.50E-01	3.21E+00
Abiotic depletion potential - non-fossil resources (ADPE)	kg Sb eq.	1.18E-03	1.35E-04	1.67E-04	1.48E-03
Abiotic depletion potential - fossil resources (ADPF)	MJ, net calorific value	6.49E+03	9.66E+02	3.66E+03	1.11E+04
Water (user) deprivation potential (WDP)	m3 world eq. deprived	4.85E+01	2.21E+00	5.07E+01	1.01E+02
Global warming potential (GWP-GHG)	kg CO2 eq.	3.73E+02	7.07E+01	2.83E+02	7.27E+02

3.2. Life Cycle Inventory Results

Table 10. Additional voluntary environmental impact indicators (OPTIONAL)

PARAMETER	UNIT (PER TON)	A1	A2	A3	A1-A3
Particulate matter emissions (PM)	Disease incidence	6.36E-07	3.49E-06	3.69E-06	7.81E-06
Ionizing radiation, human health (IRP)	kBq U235 eq.	1.69E+05	4.60E+00	4.34E+01	1.69E+05
Eco-toxicity - freshwater (ETP-fw)	CTUe	6.28E+02	2.51E+02	7.64E+02	1.64E+03
Human toxicity, cancer effect (HTP-c)	CTUh	5.89E-09	8.46E-09	8.04E-09	2.24E-08
Human toxicity, non-cancer effects (HTP-nc)	CTUh	4.00E-08	1.53E-08	4.19E-08	9.72E-08
Land use related impacts/Soil quality (SQP)	dimensionless	8.00E+01	3.59E+02	3.11E+02	7.50E+02



ENVIRONMENTAL PRODUCT DECLARATION

TUNG HO STEEL ENTERPRISE CORP.



HOT ROLLED STRUCTURAL STEEL SECTIONS

According to ISO 14025,
EN 15804 + A2

Table 11. Resource Use

PARAMETER	UNIT (PER TON)	A1	A2	A3	A1-A3
Use of renewable primary energy as energy carrier (PERE)	MJ, net calorific value	3.30E+00	9.11E+00	9.47E+01	1.07E+02
Use of renewable primary energy resources used as raw materials (PERM)	MJ, net calorific value	4.13E+00	3.94E+00	5.63E+01	6.44E+01
Total use of renewable primary energy (PERT)	MJ, net calorific value	7.43E+00	1.31E+01	1.51E+02	1.71E+02
Use of non renewable primary energy as energy carrier (PENRE)	MJ, net calorific value	2.27E+03	1.04E+03	3.91E+03	7.21E+03
Use of non renewable primary energy resources used as raw materials (PENRM)	MJ, net calorific value	2.43E+00	9.98E+00	7.25E+00	1.97E+01
Total use of non renewable primary energy resource (PENRT)	MJ, net calorific value	8.70E+00	1.05E+03	1.89E+02	1.24E+03
Use of secondary material (SM)	kg	7.55E+00	5.37E+03	0.00E+00	5.38E+03
Use of renewable secondary fuels (RSF)	MJ, net calorific value	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of non-renewable secondary fuels (NRSF)	MJ, net calorific value	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RE (recovered energy)	[MJ, LHV]	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Net use of fresh water (FW)	m3	3.24E+00	2.30E+00	5.11E+01	5.67E+01

Table 12. Output Flows and Waste Categories

PARAMETER	UNIT (PER TON)	A1	A2	A3	A1-A3
Hazardous waste disposed (HWD)	kg	2.33E-03	1.40E-03	1.87E-03	5.60E-03
Non-hazardous waste disposed (NHWD)	kg	8.39E+00	2.33E+01	1.50E+01	4.67E+01
HLRW(High-level radioactive waste, conditioned,to final repository)	[kg] or [m3]	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ILLRW(Intermediate- and low-level radioactive waste, conditioned,to final repository)	[kg] or [m3]	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Radioactive waste disposed (RWD)	kg	1.58E-03	6.67E-03	1.13E-02	1.96E-02
Components for re-use (CRU)	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for recycling (MFR)	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for energy recovery (MER)	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported electrical energy (EEE)	MJ, net calorific value	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported thermal energy (EET)	MJ, net calorific value	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 13. Carbon Emissions and Removals

PARAMETER	UNIT (PER TON)	A1	A2	A3	A1-A3
BCRP(Biogenic Carbon Removal from Product)	[kg CO2]	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BCEP (Biogenic Carbon Emission from Product)	[kg CO2]	0.00E+00	0.00E+00	1.48E-01	1.48E-01



ENVIRONMENTAL PRODUCT DECLARATION

 **TUNG HO STEEL ENTERPRISE CORP.**



HOT ROLLED STRUCTURAL STEEL SECTIONS

According to ISO 14025,
EN 15804 + A2

BCRK (Biogenic Carbon Removal from Packaging)	[kg CO2]	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BCEK (Biogenic Carbon Emission from Packaging)	[kg CO2]	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BCEW(Biogenic Carbon Emission from Combustion of Waste from Renewable Sources Used in Production Processes)	[kg CO2]	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CCE (Calcination Carbon Emissions)	[kg CO2]	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CCR (Carbonation Carbon Removals)	[kg CO2]	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CWNR (Carbon Emissions from Combustion of Waste from Non-Renewable Sources used in Production Processes)	[kg CO2]	0.00E+00	0.00E+00	0.00E+00	0.00E+00

4. LCA Interpretation

The highest proportion of GWP-total(Global warming potential total) impact of the product is module A1 (raw material supply), 46.09%. The highest proportion of GWP-fossil(Global warming potential fossil fuels) impact of the product is module A1 (raw material supply), 51.35%. The highest proportion of GWP-biogenic(Global warming potential biogenic) impact of the product is module A1 (raw material supply), 113.02%. The highest proportion of GWP-luluc(GWP from land use and land use change) impact of the product is module A3 (Manufacturing), 47.97%. The highest proportion of ODP(Depletion potential of the stratospheric ozone layer) impact of the product is module A1 (raw material supply), 93.68%. The highest proportion of AP(Acidification potential, accumulated exceedance) impact of the product is module A1 (raw material supply), 44.79%. The highest proportion of EP-freshwater(Eutrophication, fraction of nutrients reaching freshwater end compartment) impact of the product is module A3 (Manufacturing), 56.93%. The highest proportion of EP-marine(Eutrophication, fraction of nutrients reaching marine end compartment) impact of the product is module A1 (raw material supply), 38.96%. The highest proportion of EP-terrestrial(Eutrophication, accumulated exceedance) impact of the product is module A2 (Transportation), 40.88%. The highest proportion of POCP(Formation potential of tropospheric ozone photochemical oxidants) impact of the product is module A1 (raw material supply), 42.05%. The highest proportion of ADP- minerals & metals(Abiotic depletion potential for non-fossil resources) of the product is module A1(raw material supply), 79.63%. The highest proportion of ADP-fossil(Abiotic depletion potential for fossil resources) of the product is module A1 (raw material supply), 58.36%. The highest proportion of WDP(Water (user) deprivation potential, deprivation weighted water consumption) impact of the product is module A3 (Manufacturing), 49.99%.

ENVIRONMENTAL PRODUCT DECLARATION

TUNG HO STEEL ENTERPRISE CORP.



HOT ROLLED STRUCTURAL STEEL SECTIONS

According to ISO 14025,
EN 15804 + A2

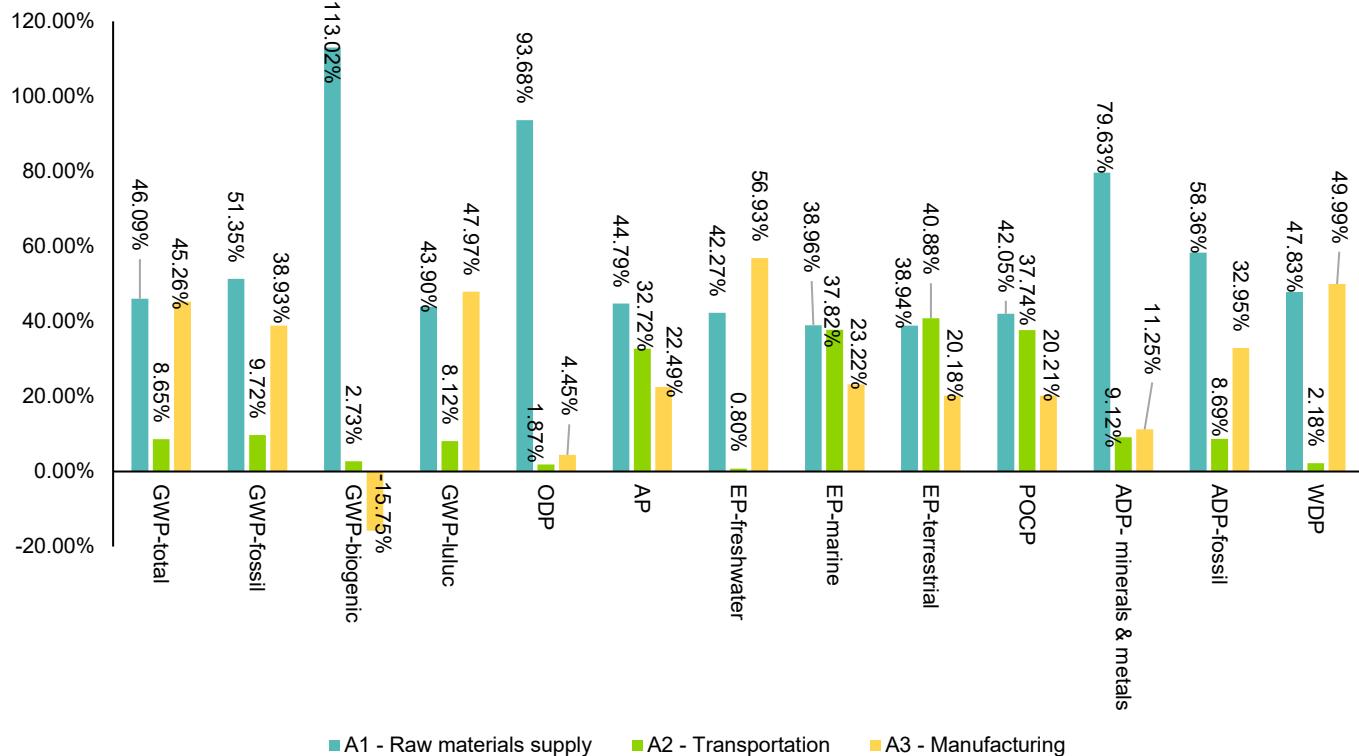


Figure 2. RESULTS OF THE LCA - ENVIRONMENTAL IMPACT

Sensitivity Check

The study considered sensitivities of most uncertain and significant aspects of the data set, including “input of EAF COAL(DM64)”, “transportation distance of overseas scrap (DM1)” and “in put of the other electricity thermal power”. After adjusting 20% on each item and check the changes of each LCA result, the results of sensitivity check is as shown on the tables below. All sensitivities of each LCA results are under 15%.

Table 14. Sensitivity Analysis for Stage A1

IMPACT CATEGORY	ITEM OF SENSITIVITY CHECK	THE CURRENT LCA RESULT	THE LCA RESULT AFTER ADJUSTING 20% ON INPUT OF EAF COAL(DM64)	SENSITIVITY(%)
GWP-total(Global warming potential total)	EAF coal(DM64)	8.17E+02	8.42E+02	3.08%
GWP-fossil(Global warming potential fossil fuels)	EAF coal(DM64)	7.26E+02	7.51E+02	3.45%
GWP-biogenic(Global warming potential biogenic)	EAF coal(DM64)	3.02E+00	3.11E+00	2.87%

ENVIRONMENTAL PRODUCT DECLARATION

 **TUNG HO STEEL ENTERPRISE CORP.**



HOT ROLLED STRUCTURAL STEEL SECTIONS

According to ISO 14025,
EN 15804 + A2

GWP-luluc(GWP from land use and land use change)	EAF coal(DM64)	5.21E-01	5.30E-01	1.78%
ODP(Depletion potential of the stratospheric ozone layer)	EAF coal(DM64)	3.28E-06	3.33E-06	1.57%
AP(Acidification potential, accumulated exceedance)	EAF coal(DM64)	5.19E+00	5.38E+00	3.73%
EP-freshwater(Eutrophication, fraction of nutrients reaching freshwater end compartment)	EAF coal(DM64)	3.74E-01	3.89E-01	4.03%
EP-marine(Eutrophication, fraction of nutrients reaching marine end compartment)	EAF coal(DM64)	1.10E+00	1.13E+00	2.56%
EP-terrestrial(Eutrophication, accumulated exceedance)	EAF coal(DM64)	1.13E+01	1.16E+01	2.53%
POCP(Formation potential of tropospheric ozone photochemical oxidants)	EAF coal(DM64)	3.21E+00	3.29E+00	2.45%
ADP- minerals & metals(Abiotic depletion potential for non-fossil resources)	EAF coal(DM64)	1.48E-03	1.50E-03	0.94%
ADP-fossil(Abiotic depletion potential for fossil resources)	EAF coal(DM64)	1.11E+04	1.15E+04	3.18%
WDP(Water (user) deprivation potential, deprivationweighted water consumption)	EAF coal(DM64)	1.01E+02	1.03E+02	1.53%



ENVIRONMENTAL PRODUCT DECLARATION

TUNG HO STEEL ENTERPRISE CORP.



HOT ROLLED STRUCTURAL STEEL SECTIONS

According to ISO 14025,
EN 15804 + A2

Table 15. Sensitivity Analysis for Stage A2

IMPACT CATEGORY	ITEM OF SENSITIVITY CHECK	THE CURRENT LCA RESULT	THE LCA RESULT AFTER ADJUSTING 20% ON INPUT OF SEA TRANSPORTATION DISTANCE OF SCRAP(DM1)	SENSITIVITY(%)
GWP-total(Global warming potential total)	Sea Transportation distance of Scrap(DM1)	8.17E+02	8.20E+02	0.36%
GWP-fossil(Global warming potential fossil fuels)	Sea Transportation distance of Scrap(DM1)	7.26E+02	7.29E+02	0.41%
GWP-biogenic(Global warming potential biogenic)	Sea Transportation distance of Scrap(DM1)	3.02E+00	3.02E+00	0.04%
GWP-luluc(GWP from land use and land use change)	Sea Transportation distance of Scrap(DM1)	5.21E-01	5.23E-01	0.39%
ODP(Depletion potential of the stratospheric ozone layer)	Sea Transportation distance of Scrap(DM1)	3.28E-06	3.28E-06	0.06%
AP(Acidification potential, accumulated exceedance)	Sea Transportation distance of Scrap(DM1)	5.19E+00	5.29E+00	1.87%
EP-freshwater(Eutrophication, fraction of nutrients reaching freshwater end compartment)	Sea Transportation distance of Scrap(DM1)	3.74E-01	3.74E-01	0.02%
EP-marine(Eutrophication, fraction of nutrients reaching marine end compartment)	Sea Transportation distance of Scrap(DM1)	1.10E+00	1.12E+00	2.18%
EP-terrestrial(Eutrophication, accumulated exceedance)	Sea Transportation distance of Scrap(DM1)	1.13E+01	1.16E+01	2.35%
POCP(Formation potential of tropospheric ozone photochemical oxidants)	Sea Transportation distance of Scrap(DM1)	3.21E+00	3.28E+00	2.14%
ADP- minerals & metals(Abiotic depletion potential for non-fossil resources)	Sea Transportation distance of Scrap(DM1)	1.48E-03	1.49E-03	0.28%
ADP-fossil(Abiotic depletion potential for fossil resources)	Sea Transportation distance of Scrap(DM1)	1.11E+04	1.12E+04	0.34%



ENVIRONMENTAL PRODUCT DECLARATION

TUNG HO STEEL ENTERPRISE CORP.



HOT ROLLED STRUCTURAL STEEL SECTIONS

According to ISO 14025,
EN 15804 + A2

WDP(Water (user) deprivation potential, deprivation weighted water consumption)	Sea Transportation distance of Scrap(DM1)	1.01E+02	1.01E+02	0.06%
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Table 16. Sensitivity Analysis for Stage A3

IMPACT CATEGORY	ITEM OF SENSITIVITY CHECK	THE CURRENT LCA RESULT	THE LCA RESULT AFTER ADJUSTING 20% ON THE OTHER ELECTRICITY THERMAL POWER	SENSITIVITY(%)
GWP-total(Global warming potential total)	other electricity Thermal power	8.17E+02	8.70E+02	6.45%
GWP-fossil(Global warming potential fossil fuels)	other electricity Thermal power	7.26E+02	7.79E+02	7.26%
GWP-biogenic(Global warming potential biogenic)	other electricity Thermal power	3.02E+00	2.89E+00	-4.22%
GWP-luluc(GWP from land use and land use change)	other electricity Thermal power	5.21E-01	5.70E-01	9.52%
ODP(Depletion potential of the stratospheric ozone layer)	other electricity Thermal power	3.28E-06	3.30E-06	0.65%
AP(Acidification potential, accumulated exceedance)	other electricity Thermal power	5.19E+00	5.93E+00	14.33%
EP-freshwater(Eutrophication, fraction of nutrients reaching freshwater end compartment)	other electricity Thermal power	3.74E-01	4.17E-01	11.35%
EP-marine(Eutrophication, fraction of nutrients reaching marine end compartment)	other electricity Thermal power	1.10E+00	1.14E+00	3.87%
EP-terrestrial(Eutrophication, accumulated exceedance)	other electricity Thermal power	1.13E+01	1.17E+01	3.26%
POCP(Formation potential of tropospheric ozone photochemical oxidants)	other electricity Thermal power	3.21E+00	3.32E+00	3.30%
ADP- minerals & metals(Abiotic depletion potential for non-fossil resources)	other electricity Thermal power	1.48E-03	1.51E-03	1.91%



ENVIRONMENTAL PRODUCT DECLARATION

TUNG HO STEEL ENTERPRISE CORP.



HOT ROLLED STRUCTURAL STEEL SECTIONS

According to ISO 14025,
EN 15804 + A2

ADP-fossil(Abiotic depletion potential for fossil resources)	other electricity Thermal power	1.11E+04	1.18E+04	6.37%
WDP(Water (user) deprivation potential, deprivation-weighted water consumption)	other electricity Thermal power	1.01E+02	1.08E+02	6.68%

Table 15. Information on disclaimer for environmental indicators

ILCD CLASSIFICATION	INDICATOR	DISCLAIMER
ILCD Type 1	Global warming potential (GWP)	none
	Depletion potential of the stratospheric ozone layer (ODP)	none
	Potential incidence of disease due to PM emissions (PM)	none
ILCD Type 2	Acidification potential, Accumulated Exceedance (AP)	none
	Eutrophication potential, Fraction of nutrients reaching freshwater end compartment (EP-freshwater)	none
	Eutrophication potential, Fraction of nutrients reaching marine end compartment (EP-marine)	none
	Eutrophication potential, Accumulated Exceedance (EP-terrestrial)	none
	Formation potential of tropospheric ozone (POCP)	none
	Potential Human exposure efficiency relative to U235 (IRP)	1
ILCD Type 3	Abiotic depletion potential for non-fossil resources (ADP-minerals&metals)	2
	Abiotic depletion potential for fossil resources (ADP- fossil)	2
	Water (user) deprivation potential, deprivation-weighted water consumption (WDP)	2
	Potential Comparative Toxic Unit for ecosystems (ETP- fw)	2
	Potential Comparative Toxic Unit for humans (HTP-c)	2
	Potential Comparative Toxic Unit for humans (HTP-nc)	2
	Potential Soil quality index (SQP)	2

Disclaimer 1 – This impact category deals mainly with the eventual impact of low dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator.

Disclaimer 2 – The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.

Critical review

The purpose of the project report is not a comparative assertion, but an independent disclosure, so the critical review is not performed.



ENVIRONMENTAL PRODUCT DECLARATION



HOT ROLLED STRUCTURAL STEEL SECTIONS

According to ISO 14025,
EN 15804 + A2

5. Additional Environmental Information

3.3. Environment and Health During Manufacturing

Tung Ho Steel Enterprise Corporation Miaoli Works is certified according to ISO14001 Environment Management System, ISO 45001 Occupational Health and Safety Management System and ISO 46001 Water efficiency management systems.

More information can be found at <https://www.tunghosteel.com/Home/Index>

3.4. Environment and Health During Installation

This inventory calculation covers stages A1 to A3, and the scope of the inventory does not include Environment and Health During Installation.

3.5. Extraordinary Effects

Fire

Special Fire Fighting Procedures - Do not use water on molten metal. Do not use Carbon Dioxide (CO₂). Firefighters should not enter confined spaces without wearing NIOSH/MSHA approved positive pressure breathing apparatus (SCBA) with full face mask and full protective equipment.

Unusual Fire or Explosion Hazards - Steel products do not present fire or explosion hazards under normal conditions. Any non-oxidized fine metal particles generated by grinding, sawing, abrasive blasting, and customer processes may produce materials that the customer should test for combustibility and other hazards in accordance with applicable regulations. High concentrations of combustible metallic fines in the air may present an explosion hazard.

Water

Not relevant

Mechanical Destruction

Not relevant

3.6. Delayed Emissions

No delayed emissions are expected from these products.

3.7. Environmental Activities and Certifications

Environmental policy at TUNG HO STEEL ENTERPRISE CORP. Miaoli Works has achieved remarkable outcomes.

Our policy of environment, with "continuous waste reduction, maintenance of the natural environment, improvement of the working environment, and commitment to sustainable business operations" as our basic value, we make efforts to be its liaison.

Certifications:



ENVIRONMENTAL PRODUCT DECLARATION



HOT ROLLED STRUCTURAL STEEL SECTIONS

According to ISO 14025,
EN 15804 + A2

TUNG HO STEEL ENTERPRISE CORP. Miaoli Works is certified under ISO 14064, ISO 14067 Verification Statement, ISO 14001 for environmental management, ISO 45001 for occupational health and safety, ISO 46001 for Water efficiency management system, and ISO 50001 for energy management.

Environmental Policy:

[Continuous Waste Reduction, Maintenance of the Natural Environment, Improvement of the Working Environment, Commitment to Sustainable Business Operations]

Tung Ho Steel Enterprise Corporation, Miaoli Works is a specialized manufacturing facility for steel sections, steel plates, and steel sheet piles. During the production process, resources such as water, electricity, oil, and gas are consumed. To maintain the natural environment and fulfill our environmental responsibilities, we provide appropriate protective equipment and facilities, implement operational controls, and continuously improve the working environment and reduce environmental impacts. We are committed to the following:

1. Promote industrial waste reduction, energy conservation, and process improvement to ensure compliance with regulations regarding air, water, and waste management.
2. Achieve environmental management performance through a spirit of continuous improvement and pollution prevention.
3. Comply with government environmental protection laws and regulations as well as the operational standards established by our plant.
4. Establish an environmental management system to set and review environmental goals and targets.
5. Develop operational standards and provide environmental education to employees, enhancing their ability to manage the environment independently and recognize their responsibilities through collective consensus.
6. Establish effective communication channels with relevant groups and nearby residents to help them understand our environmental policy and practices, working together for the environment.

More information on TUNG HO STEEL ENTERPRISE CORP's certifications environmental activities can be found at <https://www.tunghosteel.com>

3.8. Further Information

Additional information can be obtained from <https://www.tunghosteel.com/Home/Index>

6. Conclusion and Recommendation

This LCA Report has provided an assessment of the potential environmental impacts associated with the system boundary "cradle to gate", including module A1(raw material supply) & module A2(transportation) & module A3(manufacturing). The LCA software used for this study is SimaPro 10.2.0.0, the LCI databases include Ecoinvent 3, EF database 3.1, EF Database 2.0, Ecoinvent unit processes, Ecoinvent system processes, USLCI+, and LCA Database, and LCIA methodologies include EN 15804 + A2 Method version 1.03, EDIP2003 version 1.07, AWARE version 1.07, and Cumulated Exergy Demand method version 1.09.

The specific site of this study is located in Miaoli County, Taiwan. However, most of databases we used as environmental impact factors are not local database. In the future, if the local government can develop more databases of environmental impact factors, it will be very helpful for preciser assessment of the potential environmental impacts. The study is not intended to support comparative assertions intended to be disclosed to the public.

ENVIRONMENTAL PRODUCT DECLARATION



HOT ROLLED STRUCTURAL STEEL SECTIONS



According to ISO 14025,
EN 15804 + A2

7. References

EN 15804

EN 15804:201204+A2 2019, Sustainability of construction works – Environmental product declarations - Core rules for the product category of construction products.

ISO 14025

DIN EN ISO 14025:201110, Environmental labels and declarations — Type III environmental declarations — Principles and procedures.

SimaPro

SimaPro 10.2.0.0, the LCI databases include Ecoinvent 3, EF database 3.1, EF Database 2.0, Ecoinvent unit processes, Ecoinvent system processes, USLCI+, and LCA Database. LCIA methodologies include EN 15804 + A2 Method version 1.03, EDIP2003 version 1.07, AWARE version 1.07, and Cumulated Exergy Demand method version 1.09.

Product Category Rules

EPD system product category rules (PCR)
Construction Products PCR 2019:14 version 2.0.1

8. Study Commissioner



TUNG HO STEEL ENTERPRISE CORP.

Miaoli Works

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Township, Miaoli County 36842, Taiwan

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9. LCA Practitioner



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