

Declaration Owner

North Star BlueScope Steel, LLC
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Delta, OH 43515
Phone: (419) 822-2120
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Product:

Hot banded steel coil

Declared Unit

The declared unit is one metric ton of hot banded steel coil.

EPD Number and Period of Validity

SCS-EPD-09088
EPD Valid June 12, 2023 through June 11, 2028

Product Category Rule

PCR Guidance for Version 3.2. UL Environment. Sept. 2018

PCR Guidance for Building-Related Products and Services. Part B: Designated Steel Construction Product EPD Requirements. UL Environment. August 2020.

Program Operator

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Declaration owner:	North Star BlueScope Steel, LLC
Address:	6767 County Road 9, Delta, OH 43515
Declaration Number:	SCS-EPD-09088
Declaration Validity Period:	EPD Valid June 12, 2023 through June 11, 2028
Program Operator:	SCS Global Services
Declaration URL Link:	https://www.scsglobalservices.com/certified-green-products-guide
LCA Practitioner:	Tess Garvey, Ph.D., SCS Global Services
LCA Software and LCI database:	OpenLCA 1.11 software and the Ecoinvent v3.7.1 database
Product's Intended Application:	Hot banded steel coil
Product RSL:	n/a
Markets of Applicability:	Global
EPD Type:	Product-Specific
EPD Scope:	Cradle-to-Gate
LCIA Method and Version:	CML-IA and TRACI 2.1
Independent critical review of the LCA and data, according to ISO 14044 and ISO 14071	☐ internal ☒ external
LCA Reviewer:	Lindita Bushi, Ph.D., Athena Sustainable Materials Institute
Part A Product Category Rule:	PCR Guidance for Building-Related Products and Services Part A: Life Cycle Assessment Calculation Rules and Report Requirements. Version 3.2. UL Environment. Sept. 2018
Part A PCR Review conducted by:	Lindita Bushi, PhD (Chair); Hugues Imbeault-Tétreault, ing., M.Sc.A.; Jack Geibig
Part B Product Category Rule:	PCR Guidance for Building-Related Products and Services. Part B: Designated Steel Construction Product EPD Requirements. UL Environment. August 2020.
Part B PCR Review conducted by:	Thomas Gloria, PhD; Brandie Sebastian, James Littlefield
Independent verification of the declaration and data, according to ISO 14025 and the PCR	☐ internal ☒ external
EPD Verifier:	Lindita Bushi, Ph.D., Athena Sustainable Materials Institute
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Disclaimers: *This EPD conforms to ISO 14025, 14040, 14044, and ISO 21930:2017.*

Scope of Results Reported: *The PCR requirements limit the scope of the LCA metrics such that the results exclude environmental and social performance benchmarks and thresholds, and exclude impacts from the depletion of natural resources, land use ecological impacts, ocean impacts related to greenhouse gas emissions, risks from hazardous wastes and impacts linked to hazardous chemical emissions.*

Accuracy of Results: *Due to PCR constraints, this EPD provides estimations of potential impacts that are inherently limited in terms of accuracy.*

Comparability: *The PCR this EPD was based on was not written to support comparative assertions. EPDs based on different PCRs, or different calculation models, may not be comparable. When attempting to compare EPDs or life cycle impacts of products from different companies, the user should be aware of the uncertainty in the final results, due to and not limited to, the practitioner's assumptions, the source of the data used in the study, and the specifics of the product modeled.*

In accordance with ISO 21930:2017, EPDs are comparable only if they comply with the core PCR, use the same sub-category PCR where applicable, include all relevant information modules and are based on equivalent scenarios with respect to the context of construction works.

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1. North Star Blue Scope Steel, LLC

North Star BlueScope is an EAF steelmaking and rolling mill in Delta, Ohio. North Star BlueScope LLC is owned by BlueScope, a leading international supplier of steel products and building solutions found in the global building and construction industry based in Melbourne, Australia.

2. Products

2.1 PRODUCT DESCRIPTION

The hot rolled band in this study is used in a variety of construction applications and as such no specific construction codes are applicable. North Star BlueScope produces hot rolled band with an average density of 7,850 kg/m^3.

The products are available in a variety of sizes and thicknesses, as described in Table 2.

2.2 PRODUCT FLOW DIAGRAM

A flow diagram illustrating the production processes and life cycle phases included in the scope of the EPD is provided below.

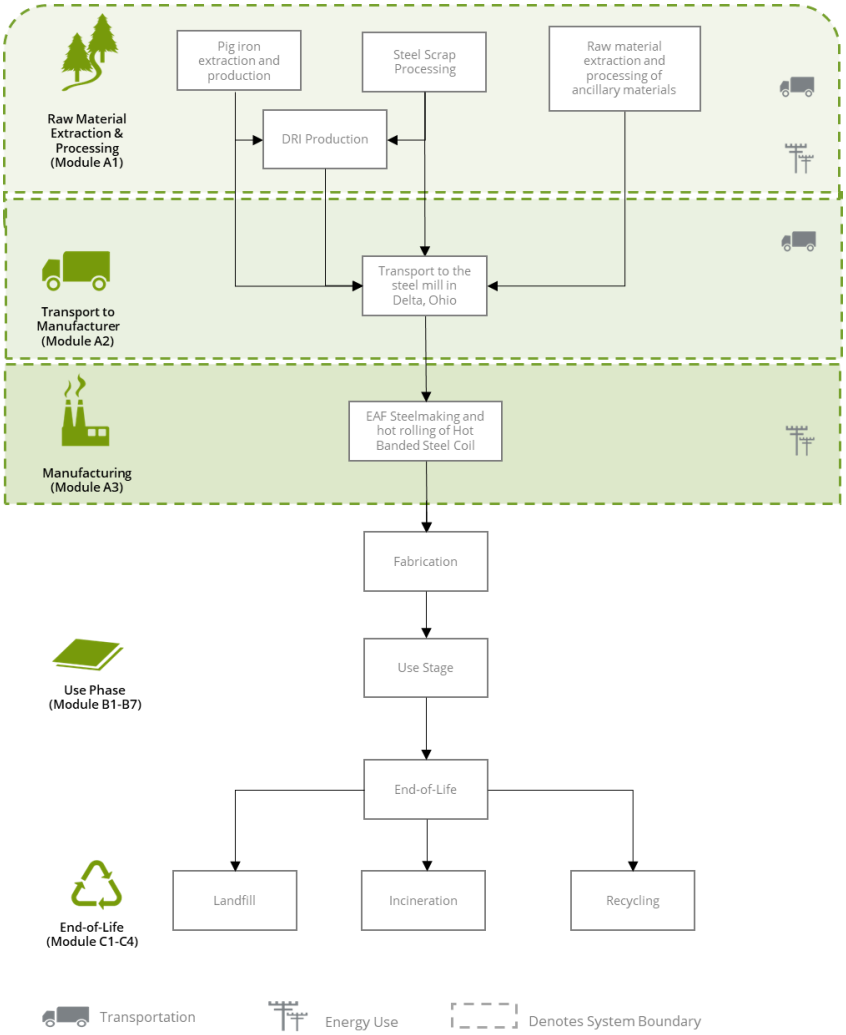


Figure 1. *Flow diagram representing the major processes in the production of hot banded steel coil product.*

2.3 DECLARATION OF METHODOLOGICAL FRAMEWORK

The scope of the EPD is cradle-to-gate, the extraction of raw materials and processing, including all activities and transport necessary for the production of hot banded steel coil product at the steel mill. The life cycle phases included in the product system boundary are shown below.

Table 1. *Life cycle phases included in the North Star hot banded steel coil product system boundary.*

Product			Construction Process		Use							End-of-life				Benefits and loads beyond the system boundary
A1	A2	A3	A4	A5	B1	B1	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Raw material extraction and processing	Transport to manufacturer	Manufacturing	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	MND	MND	MND	MND	MND

X = Module Included | MND = Module Not Declared

Cut-off and allocation procedures are described below and conform to the PCR and ISO standards. In conformance with ISO 21930 this study follows an attributional approach in which the actual or anticipated specific or average supply chain are modeled. In the attributional approach, co-production processes are allocated based on physical or economic relationships, described in more detail in Section 3.8.

2.4 TECHNICAL DATA

The low carbon product conforms to ASTM: A1011, A1018, A658, SAE J403, CQ, DQ; the medium carbon product conforms to ASTM A1011, A1018 and the high strength, low alloy product conforms to ASTM 45-100 and SAE 100.

2.5 INTENDED APPLICATION

The hot banded steel coil is the basis for numerous commercial applications in the construction industry.

2.6 MATERIAL COMPOSITION

The steel coil contains less than or equal to 99% iron, and less than or equal to 1.7% manganese, 1% copper, 0.4% carbon, 0.8% silicon, 0.3% nickel, 0.3% chromium, 0.3% molybdenum, 0.1% phosphorus, and less than 0.1% of other alloys.

Steel products under normal conditions do not present inhalation, ingestion, or contact health hazards. These products are used inside the building envelope, or other structures, and do not include materials or substances which have potential route of exposure to humans or flora/fauna in the environment.

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2.7 PROPERTIES OF DECLARED PRODUCT AS DELIVERED

The products are available in various sizes and thicknesses, as described in Table 2.

Table 2. *Products, sizes, and specifications.*

Product	Gauges	Widths	Certifications
Low Carbon	1.27-12.95 mms (0.050 – 0.510 inches (min))	1.0-1.58 m (40 – 62.25 inches)	ASTM A1011[1] (Grade 45 – Grade 100) ASTM A1018[2] (Gr45 – Gr100) ASTM A572[3] (Gr50/Gr55) ASTM ASTM A656[4] (Gr50/Gr80) ASTM SAE J1392[5] (40, 45, 50, 60, 70, 80) SAE J2340[6] (Grades: 300X, 340X, 340Y, 380X, 380Y, 420X, 420Y, 490X, 490Y, 550X, 550Y)
Medium Carbon	1.47-12.7 mms (0.058 – 0.500 inches (min))	1.0-1.56 m (40 – 61.50 inches)	
High Strength, Low Alloy	1.27-12.7 mms (0.50– 0.500 inches (min)) *Min gauge will depend on strength level	1.0-1.56 m (40 - 61.50 inches)	

2.8 MANUFACTURING

The steel coil in this study is manufactured primarily from steel scrap, sourced from various aftermarkets and on-site scrap, as well as some pig iron and a small amount of hot briquetted iron. The steel is manufactured into slab using EAF steelmaking and rolled into steel coil at the Delta, Ohio mill in the United States.

2.9 PACKAGING

Packaging for the steel band is negligible and falls under the cut-off criteria.

2.10 FURTHER INFORMATION

Further information on the product can be found on the manufacturers' website at https://nsbsl.com

[1] ASTM A1011: Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
[2] ASTM A1018/A1018M-18 Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Hot-Rolled, Carbon, Commercial, Drawing, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
[3] ASTM A572/A572M-12 Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
[4] ASTM A656/A656M-18 Standard Specification for Hot-Rolled Structural Steel, High-Strength Low-Alloy Plate with Improved Formability
[5] SAE J1392 Steel, High Strength, Hot Rolled Sheet and Strip, Cold Rolled Sheet, and Coated Sheet
[6] SAE J2340 Categorization and Properties of Dent Resistant, High Strength, and Ultra High Strength Automotive Sheet Steel

3. LCA: Calculation Rules

3.1 DECLARED UNIT

The declared unit used in this study is one metric ton of hot banded steel coil, consistent with the PCR.

Table 3. *The modules and unit processes included in the scope for the North Star hot banded steel coil.*

Module	Module Description	Unit Processes Included in Scope
A1	Extraction and processing of raw materials; any reuse of products or materials from previous product systems; processing of secondary materials; generation of electricity from primary energy resources; energy, or other, recovery processes from secondary fuels	Raw material extraction and processing, including but not limited to the recovery or extraction and processing of feedstock materials and including all activities necessary for the reprocessing steel scrap.
A2	Transport (to the manufacturer)	Transportation from primary production to the North Star facility in Delta, Ohio
A3	Manufacturing, including ancillary material production	EAF Steelmaking and hot rolling of the steel coil
A4	Transport (to the building site)	Module Not Declared
A5	Construction-installation process	Module Not Declared
B1	Product use	Module Not Declared
B2	Product maintenance	Module Not Declared
B3	Product repair	Module Not Declared
B4	Product replacement	Module Not Declared
B5	Product refurbishment	Module Not Declared
B6	Operational energy use by technical building systems	Module Not Declared
B7	Operational water uses by technical building systems	Module Not Declared
C1	Deconstruction, demolition	Module Not Declared
C2	Transport (to waste processing)	Module Not Declared
C3	Waste processing for reuse, recovery and/or recycling	Module Not Declared
C4	Disposal	Module Not Declared
D	Reuse-recovery-recycling potential	Module Not Declared

3.2 UNITS

All data and results are presented using SI units.

3.3 ESTIMATES AND ASSUMPTIONS

The assessment relied on several assumptions, described below.

- Where necessary, the production of steel and steel scrap were modeled with unit process data taken from Ecoinvent. The datasets utilized for steel production are provided in Section 3.3.
- Representative inventory data for raw materials and ancillary materials were modeled with unit process data taken from Ecoinvent. Representative inventory data were used to reflect the eGRID energy mix for electricity use at the North Star facilities, RFCW.
- Impacts of the system were allocated to co-products (EAF slag) based on mass.
- Upstream transportation distances for some materials were not available. In the absence of such data, a conservative estimate of a distance of 200 mi (320 km) was used, based on communications with North Star. This assumption is tested in the sensitivity check.

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- Disposal of manufacturing waste is modeled based on statistics solid and hazardous waste generation and disposal in the United States, as specified in the PCR. Specifically, where the disposal was done by a third party, 80% of non-hazardous wastes are disposed in landfill and 20% incinerated. Transportation for end-of-life scenarios was modeled using the EPA WARM model assumption of 20 miles (~32 km), from the point of product use to a landfill, material recovery center, or waste incinerator. Ecoinvent datasets are used to model the impacts associated with incineration and landfilling, which does not include energy recovery from landfill gas.

3.4 CUT-OFF RULES

The cut-off criteria for including or excluding materials, energy, and emissions data from the study are in accordance with the PCR and are listed below.

- All inputs and outputs to a unit process are included in the LCA calculation for which data are available. Any data gaps are filled with representative data. Assumptions used for filling data gaps are documented in the LCA report.
- Where there is a data gap or insufficient data, criteria for exclusion of inputs and outputs is 1% of primary energy usage (renewable and non-renewable energy) and 1% on a mass basis for the specific unit process. The maximum criteria for exclusion of inputs and outputs is 5% of primary energy usage and mass across all modules included in the LCA.
- If a flow meets the above criteria for exclusion but is considered to have a significant potential environmental impact, it is included.

3.5 DATA SOURCES

Unit processes were developed within openLCA v1.10 software. For steelmaking and rolling, confidential primary data were provided by North Star. The principal source of secondary LCI data is Ecoinvent v3.7.1 database. Detailed descriptions of unit processes can be found in the accompanying documentation. The LCI datasets used in the LCA model to represent unit processes in the cradle-to-gate LCA are provided in Table 4 below.

Table 4. *Data sources for the North Star hot banded steel coil product.*

Flow	Dataset	Data Source	Publication Date
Raw Materials			
Steel Scrap	Scrap steel	Ecoinvent 3.7.1	2020
Pig Iron	iron ore concentrate | iron ore concentrate | Cutoff, U – GLO	Ecoinvent 3.7.1	2020
Hot Briquetted iron	market for sponge iron | sponge iron | Cutoff, U - GLO	Ecoinvent 3.7.1	2020
Carbon additions	market for petroleum coke | petroleum coke | Cutoff, U – GLO	Ecoinvent 3.7.1	2020
Hi Cal Lime and Burnt Dolomite	calcium carbonate production, precipitated | calcium carbonate, precipitated | Cutoff, U - RoW	Ecoinvent 3.7.1	2020
Carbon Electrodes	market for graphite | graphite | Cutoff, U - GLO	Ecoinvent 3.7.1	2020
Alloys			
Aluminum	market for aluminium, primary, ingot | aluminium, primary, ingot | Cutoff, U - RoW	Ecoinvent 3.7.1	2020
Low Carbon FeCr	market for ferrochromium, high carbon, 55% Cr | ferrochromium, high carbon, 55% Cr | Cutoff, U - GLO	Ecoinvent 3.7.1	2020
Ferromanganese	market for ferromanganese, high-coal, 74.5% Mn | ferromanganese, high-coal, 74.5% Mn | Cutoff, U - GLO	Ecoinvent 3.7.1	2020
Ferrosilicon	market for ferrosilicon | ferrosilicon | Cutoff, U - GLO	Ecoinvent 3.7.1	2020
Ferrotitanium	titanium production, primary | titanium, primary | Cutoff, U - GLO	Ecoinvent 3.7.1	2020
Ferrovanadium	ilmenite - magnetite mine operation | ilmenite, 54% titanium dioxide | Cutoff, U - GLO	Ecoinvent 3.7.1	2020
Ferrocolumbium	niobium mine operation and beneficiation, from pyrochlore ore | iron ore concentrate | Cutoff, U - RoW	Ecoinvent 3.7.1	2020
Ferroboron	boric oxide production | boric oxide | Cutoff, U - GLO	Ecoinvent 3.7.1	2020
Ferronickel	market for ferronickel | ferronickel | Cutoff, U - GLO	Ecoinvent 3.7.1	2020
Ferronickel	market for ferronickel | ferronickel | Cutoff, U - GLO	Ecoinvent 3.7.1	2020
Resource Use			
Electricity	electricity voltage transformation from high to medium voltage | electricity, medium voltage | Cutoff, U | - US-RFC modified for egrid subregion RFCW	Ecoinvent 3.7.1 egrid2019	2020 2021
Natural Gas	market for natural gas, high pressure | natural gas, high pressure | Cutoff, U - US	Ecoinvent 3.7.1	2020
Tap water	market for tap water | tap water | Cutoff, U - Europe without Switzerland	Ecoinvent 3.7.1	2020
Transportation			
Truck transport	transport, freight, lorry 16-32 metric ton, EURO4 | transport, freight, lorry 16-32 metric ton, EURO4 | Cutoff, U – RER	Ecoinvent 3.7.1	2020
Train transport	transport, freight train, diesel | transport, freight train | Cutoff, U - US	Ecoinvent 3.7.1	2020
Ship transport	transport, freight, sea, container ship | transport, freight, sea, container ship | Cutoff, U - GLO	Ecoinvent 3.7.1	2020

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3.6 DATA QUALITY

The data quality assessment addressed the following parameters: time-related coverage, geographical coverage, technological coverage, precision, completeness, representativeness, consistency, reproducibility, sources of data, and uncertainty.

Table 5. *Data quality assessment for the North Star hot banded steel coil product system.*

Data Quality Parameter	Data Quality Discussion
Time-Related Coverage: Age of data and the minimum length of time over which data is collected	The most recent available data are used, based on other considerations such as data quality and similarity to the actual operations. Typically, these data are less than 10 years old (typically 2017 or more recent). All of the data used represented an average of at least one year's worth of data collection. Manufacturer-supplied data (primary data) are based on a full year of operations from July 2019-June 2020 at the North Star facility.
Geographical Coverage: Geographical area from which data for unit processes is collected to satisfy the goal of the study	The data used in the analysis provide the best possible representation available with current data. Actual processes for upstream operations are primarily North American. Surrogate data used in the assessment are representative of North American operations. Data representative of European operations are considered sufficiently similar to actual processes. Data representing product disposal are based on regional statistics.
Technology Coverage: Specific technology or technology mix	For the most part, data are representative of the actual technologies used for processing, transportation, and manufacturing operations.
Precision: Measure of the variability of the data values for each data expressed	Precision of results are not quantified due to a lack of data. Data collected for operations were typically averaged for one or more years and over multiple operations, which is expected to reduce the variability of results.
Completeness: Percentage of flow that is measured or estimated	The LCA model included all known mass and energy flows for production of hot banded steel coil. In some instances, surrogate data used to represent upstream and downstream operations may be missing some data which is propagated in the model. No known processes or activities contributing to more than 1% of the total environmental impact for each indicator are excluded.
Representativeness: Qualitative assessment of the degree to which the data set reflects the true population of interest	Data used in the assessment represent typical or average processes as currently reported from multiple data sources and are therefore generally representative of the range of actual processes and technologies for production of these materials. Considerable deviation may exist among actual processes on a site-specific basis; however, such a determination would require detailed data collection throughout the supply chain back to resource extraction. For supplier information, the most representative source of data possible was chosen or modeled.
Consistency: Qualitative assessment of whether the study methodology is applied uniformly to the various components of the analysis	The consistency of the assessment is considered to be moderate to high. Data sources of similar quality and age are used with a bias towards Ecoinvent v3.7.1 data. Different portions of the product life cycle are equally considered; however, it must be noted that final disposition of the product is based on assumptions of current average practices in Europe and North America.
Reproducibility: Qualitative assessment of the extent to which information about the methodology and data values would allow an independent practitioner to reproduce the results reported in the study	Based on the description of data and assumptions used, this assessment would be reproducible by other practitioners. All assumptions, models, and data sources are documented.
Sources of the Data: Description of all primary and secondary data sources	Data representing energy use at the North Star manufacturing facilities represent an annual average and are considered of high quality due to the length of time over which these data are collected, as compared to a snapshot that may not accurately reflect fluctuations in production. The Ecoinvent database is used for secondary LCI datasets.
Uncertainty of the Information: Uncertainty related to data, models, and assumptions	Uncertainty related to materials in the steel coil is low. Actual supplier data for upstream operations was not available for all suppliers and the study relied upon the use of existing representative datasets. These datasets contained relatively recent data (<10 years) but lacked geographical representativeness. Uncertainty related to the impact assessment methods used in the study are high. The impact assessment method required by the PCR includes impact potentials, which lack characterization of providing and receiving environments or tipping points.

3.7 PERIOD UNDER REVIEW

Primary data from July 1, 2019- June 30, 2020 were collected from North Star for the Delta, Ohio facilities.

3.8 ALLOCATION

This study follows the allocation guidelines of ISO 14044 and allocation rules specified in the PCR and minimized the use of allocation wherever possible.

Mass allocation was deemed the most accurate and reproducible way of calculating the energy and material requirements for the manufacture of steel coil and its useful co-product, EAF slag. Primary data for resource use (e.g., electricity, natural gas, water), waste/byproducts, and emissions released, are allocated on a mass-basis as a fraction of total annual production. With respect to secondary materials, the 100-0 recycled content approach is used in which the recycled material bears only the burden of any processing from waste material and transportation to the facility.

The transportation from primary producer of material components to the North Star facilities are based on primary data provided by North Star, including modes, distances, and amount of steel transported. Transportation was allocated on the basis of the mass and distance the material was transported.

3.9 COMPARABILITY

The PCR this EPD was based on was not written to support comparative assertions. EPDs based on different PCRs, different programs, or different calculation models, may not be comparable. When attempting to compare EPDs or life cycle impacts of products from different companies, the user should be aware of the uncertainty in the final results, due to and not limited to, the practitioner's assumptions, the source of the data used in the study, and the specifics of the product modeled.

4. LCA: Scenarios and Additional Technical Information

Manufacturing

The steel coil in this study is manufactured primarily from steel scrap, sourced from various aftermarkets and on-site scrap, as well as some pig iron and a small amount of hot briquetted iron (HBI). The steel is manufactured into slab using EAF steelmaking and rolled into steel coil at the Delta, Ohio mill in the United States.

The North Star steelmaking facility consists of two electric arc furnaces (EAF) and one rolling mill. The facility uses ferrous scrap as a primary raw material source. Ferrous scrap metal arrives by truck and rail at the steel mill and transferred to the melt shop. At the melt shop, the electric arc furnace is charged to melt scrap. The EAF uses electric power and natural gas to heat the scrap and melt into liquid form. Slag is formed and floats to the top of the molten steel with oxidized impurities, collected and discarded. Alloys are then added to achieve the desired mechanical properties. The molten steel is transferred to the ladle refining furnace where fine adjustments are made to the composition (ferro alloys are added) and temperature adjusted, and finally rolled into flat steel sheets of the desired width and thickness, before coiling.

The North Star EAF and rolling mill is located in Delta, Ohio in the EPA eGRID RFCW subregion. The electricity supply mix for the North Star facilities are modeled using ecoinvent electricity grid for the NERC RFC region and modifying to tailor to RFCW eGRID subregion.

Disposal of manufacturing waste is modeled based on statistics solid and hazardous waste generation and disposal in the United States, as specified in the PCR. Specifically, where the disposal was done by a third party, 80% of non-hazardous wastes are disposed in landfill and 20% incinerated. Transportation for end-of-life scenarios was modeled using the EPA WARM model assumption of 20 miles (~32 km), from the point of product use to a landfill, material recovery center, or waste incinerator. Ecoinvent datasets are used to model the impacts associated with incineration and landfilling, which does not include energy recovery from landfill gas.

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5. LCA: Results

Results of the Life Cycle Assessment are presented below. It is noted that LCA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks.

The following environmental impact category indicators are reported using characterization factors based on the U.S. EPA's Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts – TRACI 2.1 and CML-IA.

Table 6. *Life cycle impact assessment categories and units.*

CMLI-A Impact Category	Unit	TRACI 2.1 Impact Category	Unit
Global Warming Potential **(GWP)**	kg CO_2 eq	Global Warming Potential **(GWP)**	kg CO_2 eq
Depletion potential of the stratospheric ozone layer **(ODP)**	kg CFC 11 eq	Ozone Depletion Potential **(ODP)**	kg CFC 11 eq
Acidification Potential of soil and water **(AP)**	kg SO_2 eq	Acidification Potential **(AP)**	kg SO_2 eq
Eutrophication Potential **(EP)**	kg PO_4^{3-} eq	Eutrophication Potential **(EP)**	kg N eq
Photochemical Oxidant Creation Potential **(POCP)**	kg C_2H_4 eq	Smog Formation Potential **(SFP)**	kg O_3 eq
Abiotic depletion potential **(ADP-elements)** for non-fossil resources	kg Sb eq	Fossil Fuel Depletion Potential **(FFD)**	MJ Surplus, LHV
Abiotic depletion potential **(ADP-fossil fuels)** for fossil resources	MJ, LHV	-	-

These six impact categories are globally deemed mature enough to be included in Type III environmental declarations. Other categories are being developed and defined and LCA should continue making advances in their development. However, the EPD users shall not use additional measures for comparative purposes.

The following inventory parameters, specified by the PCR, are also reported and calculated in conformance with the ACLCA guidance on ISO 21930:2017.

Table 7. *Resource use and waste indicators required by the PCR and units.*

Resources	Unit	Waste and Outflows	Unit
RPR_E: Renewable primary resources used as energy carrier (fuel)	MJ, LHV	**HWD:** Hazardous waste disposed	kg
RPR_M: Renewable primary resources with energy content used as material	MJ, LHV	**NHWD:** Non-hazardous waste disposed	kg
$NRPR_E$: Non-renewable primary resources used as an energy carrier (fuel)	MJ, LHV	**HLRW:** High-level radioactive waste, conditioned, to final repository	kg
$NRPR_M$: Non-renewable primary resources with energy content used as material	MJ, LHV	**ILLRW:** Intermediate- and low-level radioactive waste, conditioned, to final repository	kg
SM: Secondary materials	MJ, LHV	**CRU:** Components for re-use	kg
RSF: Renewable secondary fuels	MJ, LHV	**MR:** Materials for recycling	kg
NRSF: Non-renewable secondary fuels	MJ, LHV	**MER:** Materials for energy recovery	kg
RE: Recovered energy	MJ, LHV	**EE:** Recovered energy exported from the product system	MJ, LHV
FW: Use of net freshwater resources	m^3	-	-

Table 8. *LCIA results for the declared unit of Hot Banded Steel Coil produced at the Delta, Ohio facility. All values are rounded to three significant digits. Values below indicator results show the percent contribution of each life cycle module to the result for each impact category.*

Impact Category (Units)	A1 Upstream Raw Material Production	A2 Transport to North Star	A3 EAF Steelmaking and Hot Rolling	Total (A1-A3)
TRACI				
Global Warming Potential (kg CO_2 eq)	596	31.2	479	1,110
	54%	3%	43%	100%
Acidification Potential (kg SO_2 eq)	2.30	0.630	1.40	4.33
	53%	15%	32%	100%
Eutrophication Potential (kg N eq)	1.77	0.0439	1.53	3.35
	53%	1%	46%	100%
Smog Formation Potential (kg O_3 eq)	35.0	12.3	13.3	60.5
	58%	20%	22%	100%
Ozone Depletion Potential (kg CFC-11 eq)	$4.10x10^{-5}$	$6.82x10^{-6}$	$2.41527x10^{-5}$	$7.20x10^{-5}$
	57%	9%	34%	100%
Fossil Fuel Depletion (MJ Surplus LHV)	342	61.1	339	742
	46%	8%	46%	100%
CML-IA				
GWP (kg CO_2 eq)	606	31.3	483	1,120
	54%	3%	43%	100%
AP (kg SO_2 eq)	2.19	0.585	1.42	4.20
	52%	14%	34%	100%
EP (kg $(PO_4)^{3-}$ eq)	0.898	0.0728	0.707	1.68
	54%	4%	42%	100%
POCP (kg C_2H_4 eq)	0.276	0.0152	0.0950	0.386
	71%	4%	25%	100%
ODP (kg CFC-11 eq)	$3.37x10^{-5}$	$5.12x10^{-6}$	$1.60x10^{-5}$	$5.48x10^{-5}$
	62%	9%	29%	100%
ADPE (kg Sb eq)	$3.45x10^{-6}$	$2.53x10^{-7}$	$5.60x10^{-6}$	$9.31x10^{-6}$
	37%	3%	60%	100%
ADPF (MJ LHV)	6,400	417	4,170	11,000
	58%	4%	38%	100%

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.

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Table 9. *Resource use and waste flows per metric ton of Hot Banded Steel Coil manufactured by North Star in Delta, Ohio and percent contribution by life cycle stage. Results reported in MJ are calculated using lower heating values. All values are rounded to three significant digits.*

Parameter	A1	A2	A3	Total
Resources				
RPRE (MJ)	279	4.34	159	442
	58%	1%	41%	100%
RPRM (MJ)	0.0	0.00	0.0	0.0
	0%	0%	100%	100%
NRPRE (MJ)	5,730	399	4,710	10,800
	53%	4%	44%	100%
NRPRM (MJ)	425	0.0	0.0	425
	100%	0%	0%	100%
SM (MT)	0.818	0.0	0.0	0.818
	100%	0%	0%	100%
RSF/NRSF (MJ)	n/a	n/a	0.0	n/a
RE (MJ)	n/a	n/a	0.0	n/a
FW (m^3)	8.16	0.152	0.372	8.69
	93%	2%	5%	100%
Wastes				
HWD (kg)	n/a	n/a	0.0	0.0
	n/a	n/a	100%	100%
NHWD (kg)	n/a	n/a	1.88	1.88
	n/a	n/a	100%	100%
HLRW (kg)	n/a	n/a	n/a	n/a
	n/a	n/a	n/a	n/a
ILLRW (kg)	n/a	n/a	n/a	n/a
	n/a	n/a	n/a	n/a
CRU (kg)	n/a	n/a	0.0	0.0
MR (kg)	n/a	n/a	78.7	78.7
	n/a	n/a	100%	100%
MER (kg)	n/a	n/a	0.0	0.0
EE (MJ)	n/a	n/a	0.0	0.0

The PCR requires the calculation of carbon emissions and removals. Biogenic carbon is not included in the product or packaging. Biogenic carbon emissions are not included in the A1-A3 modules as no biogenic materials are used in the product and packaging.

- Biogenic carbon emissions and removals in product or packaging: 0.

6. LCA: Interpretation

The contributions to indicator results for hot banded steel coil are contributed by the Upstream Raw Material Production (A1) stages in most cases, followed closely by the Steelmaking and Hot Rolling stage (A3).

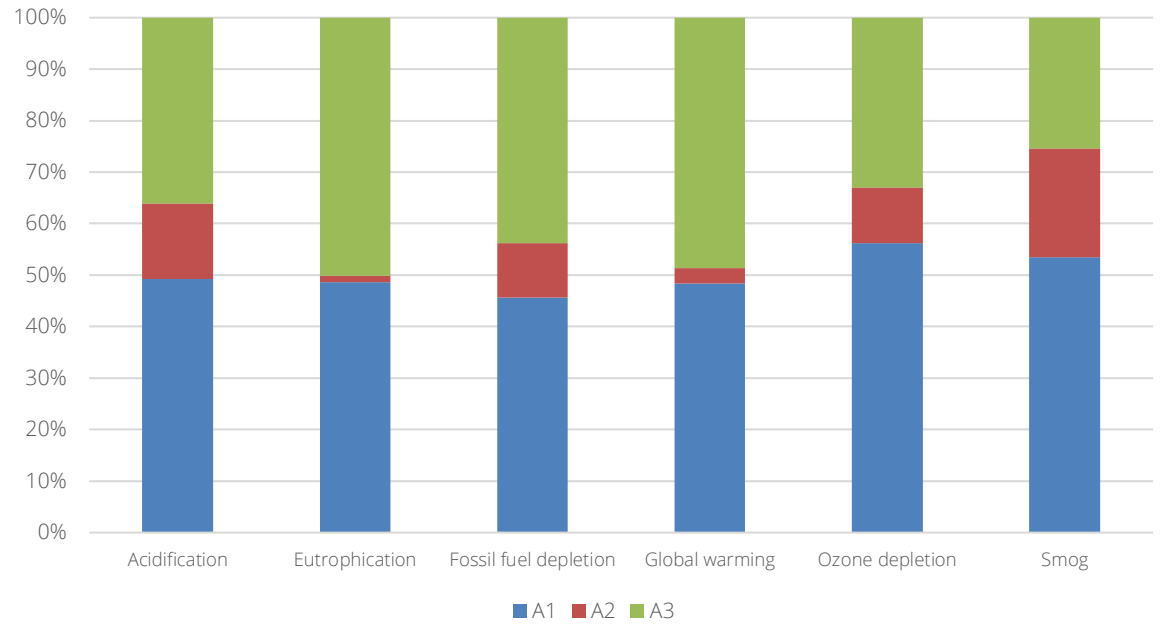


Figure 2. *Contribution analysis of module contributions to North Star Hot Banded Steel Coil impact, assessed using TRACI 2.1*

Limitations

Limitations in the Study Scope

Primary data of material components could not be modeled with actual process information. Secondary data consists of datasets from the ecoinvent database.

Comparison of the environmental performance of construction products should be based on the product's use in a building, considering the complete life cycle. Results that do not consider the complete building context are inappropriate for comparing construction products. As the scope of this LCA is the production of steel construction products, and does not include impacts on the building, indicator results presented in this LCA cannot be compared directly to another material type, unless these products have equivalent use phase impacts and identical effects on the whole building.

The results presented should be considered in the context of operational impacts from the function of the integrated whole building system. When the building lifetime is taken into account, the impacts resulting from the production of these steel products can range from small, to significant, due to the nearly limitless number of building designs possible. These impacts from the operational phase of a whole building are not the subject of this study but should be considered when interpreting results.

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7. References

- Life Cycle Assessment of Hot Banded Steel Coil for North Star BlueScope Steel, LLC. SCS Global Services Report. Prepared for North Star BlueScope Steel, LLC. May 2023.
- ISO 14025:2006 Environmental labels and declarations – Type III environmental declarations – Principles and Procedures.
- ISO 14040: 2006/ AMD1 2020 Environmental Management – Life cycle assessment – Principles and Framework
- ISO 14044: 2006/ AMD1: 2017/ AMD2: 2020 Environmental Management – Life cycle assessment – Requirements and Guidelines.
- ISO 21930:2017 Sustainability in buildings and civil engineering works — Core rules for environmental product declarations of construction products and services.
- PCR Guidance for Building-Related Products and Services Part A: Life Cycle Assessment Calculation Rules and Report Requirements. Version 3.2. UL Environment. Sept. 2018
- PCR Guidance for Building-Related Products and Services Part B: Designated Steel Construction Product EPD Requirements. Version 2. UL Environment. August 2020.
- SCS Type III Environmental Declaration Program: Program Operator Manual. V11.0 November 2021. SCS Global Services.
- Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts (TRACI). Dr. Bare, J., https://www.epa.gov/chemical-research/tool-reduction-and-assessment-chemicals-and-other-environmental-impacts-traci
- CML-IA Characterization Factors. Leiden University, Institute of Environmental Sciences. April 2013. http://cml.leiden.edu/software/data-cmlia.html
- Ecoinvent Centre (2020) ecoinvent data from v3.7.1. Swiss Center for Life Cycle Inventories, Dübendorf, 2020, http://www.ecoinvent.org
- European Joint Research Commission. International Reference Life Cycle Data System handbook. *General guide for Life Cycle Assessment – Detailed Guidance.* © European Union, 2010.
- "WARM Model Transportation Research – Draft." Memorandum from ICF Consulting to United States Environmental Protection Agency. September 7, 2004. http://epa.gov/epawaste/conserve/tools/warm/SWMGHGreport.html#background.
- ACLCA (2019). ACLCA Guidance to Calculating Non-LCIA Inventory Metrics in Accordance with ISO 21930:2017.

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