CLIFFS

VERIFIED by SCS GLOBAL SERVICES ENVIRONMENTAL PRODUCT DECLARATION BASED ON LCA

Declaration Owner

Cleveland-Cliffs Steel Inc.
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Cleveland, Ohio 44114
216.694.5700
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Product:

Hot Rolled Steel Coil

Declared Unit

The declared unit is one metric ton of low alloy steel coil produced at the Burns Harbor or Cleveland Works steel mills

EPD Number and Period of Validity

SCS-EPD-10189
EPD Valid June 20, 2024 through June 19, 2029
Version: June 3, 2026

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

SCS Global Services
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SCSglobal SERVICES

Declaration owner:	Cleveland-Cliffs Steel Inc.
Address:	200 Public Sq Suite 3300 Cleveland, Ohio 44114
Declaration Number:	SCS-EPD-10189
Declaration Validity Period:	EPD Valid June 20, 2024 through June 19, 2029
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 2.0 software and the Ecoinvent v3.9.1 database
Product's Intended Application:	Steel coil is used in various construction products
Product RSL:	n/a
Markets of Applicability:	Global
EPD Type:	Product-Specific
EPD Scope:	Cradle-to-Gate
LCIA Method and Version:	IPCC AR5 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 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, ISO 21930:2017 and the PCR	☐ internal ☒ external
EPD Verifier:	Lindita Bushi Lindita Bushi, Ph.D., Athena Sustainable Materials Institute
Declaration Contents:	

Disclaimers: *This EPD conforms to ISO 14025, 14040, 14044, and ISO 21930.*

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. Cleveland-Cliffs Steel Inc.

Cleveland-Cliffs Steel Inc. is the largest flat-rolled steel producer in North America. Founded in 1847 as a mine operator, Cliffs is also the largest manufacturer of iron ore pellets in North America. The Company is vertically integrated from mined raw materials, direct reduced iron, and ferrous scrap to primary steelmaking and downstream finishing, stamping, tooling, and tubing. The Company serves a diverse range of markets due to its comprehensive offering of flat-rolled steel products and is the largest supplier of steel to the automotive industry in North America. Headquartered in Cleveland, Ohio, Cliffs employs approximately 28,000 people across operations in the United States and Canada.

2. Products

2.1 PRODUCT DESCRIPTION

The three integrated mills produce a wide variety of coil, while the focus of this EPD will be the general construction grades of coil; that is, grades of coil which will be used only in construction applications. These grades of coil include carbon structural steels and high-strength low alloy structural steels. The differences in material content between different grades of coil in this category are negligible from an LCA perspective.

Beyond the scope of this study, the coil may be manufactured into another product which will determine the applicable CSI or UNSPSC codes. These grades of steel coil have an average density of 7,850 kg/m^3.

2.2 PRODUCT FLOW DIAGRAM

Three flow diagrams illustrating the production processes and life cycle phases included in the scope of the EPD are provided below in Figures 1 and 2.

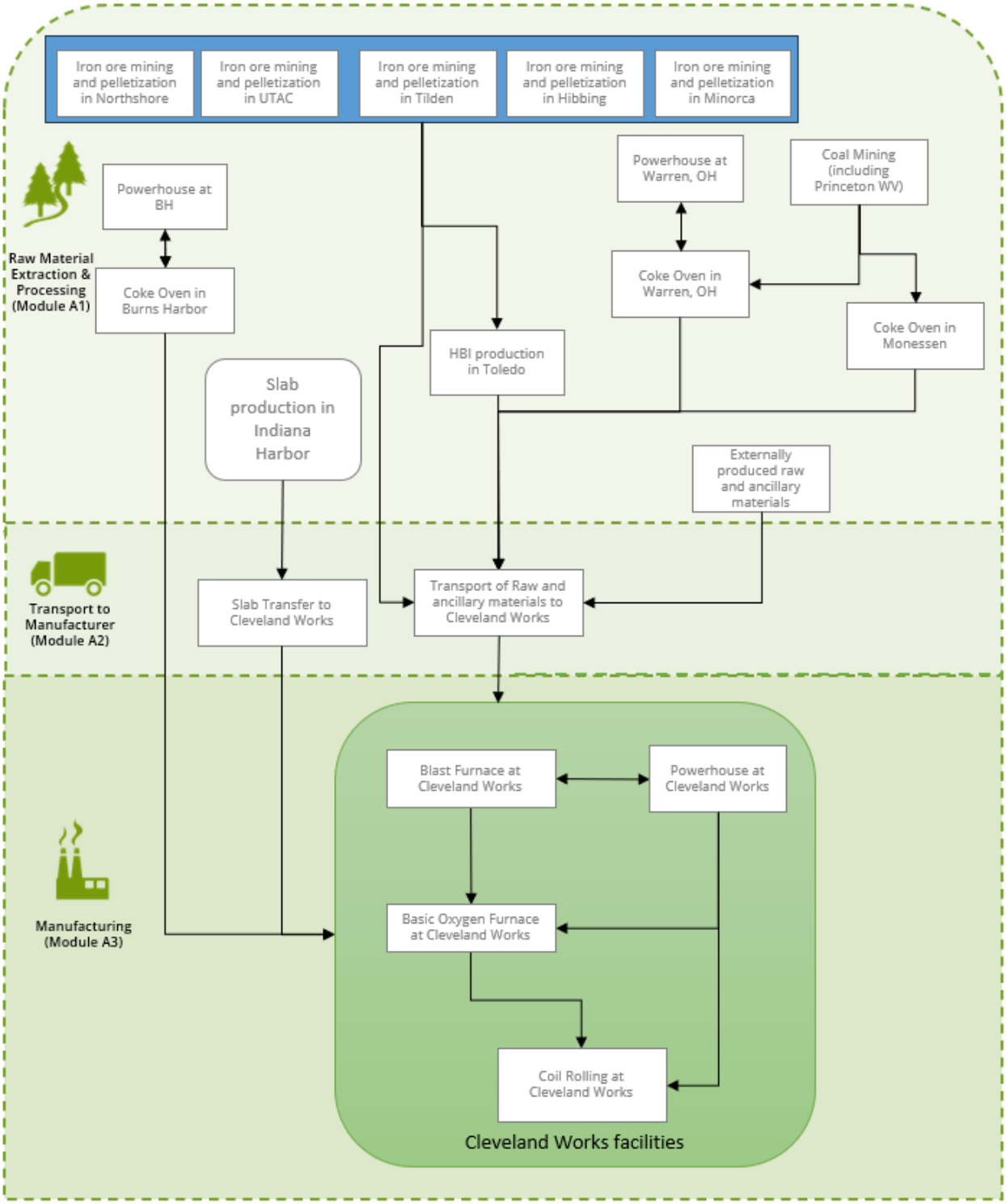

Figure 1. *Flow diagram representing the major processes in the production of the steel coil produced at Cleveland Works. (BH = Burns Harbor, UTAC=United Taconite Mine, HBI=Hot Briquetted Iron).*

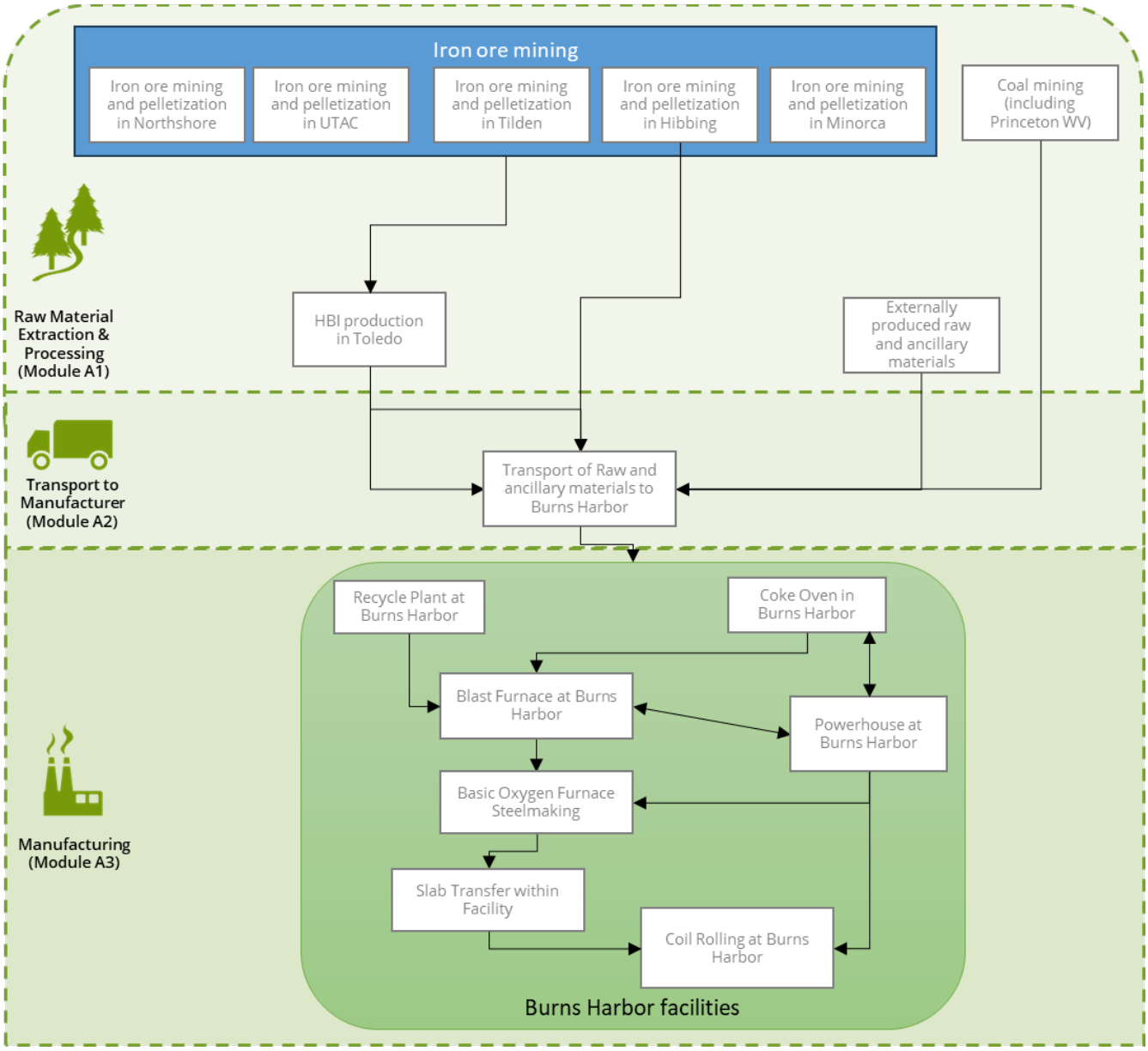

Figure 2. *Flow diagram representing the major processes in the production of the steel coil produced at Burns Harbor. (BH = Burns Harbor, UTAC=United Taconite Mine, HBI=Hot Briquetted Iron).*

2.3 DECLARATION OF METHODOLOGICAL FRAMEWORK

The scope of the EPD is cradle-to-gate, including raw material extraction and processing, transportation, steel manufacture and coil rolling. The life cycle phases included in the product system boundary are shown below. Additional detail can be found in section 3.1. Manufacturing (Module A3) consists of all on-site operations for each mill. Any materials produced outside of the respective mill are accounted for in the A1 module.

Table 1. *Life cycle phases included in the Cleveland-Cliffs 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.

2.4 TECHNICAL DATA

This LCA follows the attributional LCA approach.

Technical specifications for the steel coil in this study include ASTM A1011, ASTM A1018, and for conversion to ASTM A36, ASTM 572, ASTM 709.

2.5 INTENDED APPLICATION

The steel coil serves functions across construction applications.

2.6 MATERIAL COMPOSITION

The steel coil modeled in this study contains primarily virgin iron ore and HBI, with an alloy content lower than 5%. The steel products will contain ≤ 0.24% Carbon, < 1.6% Manganese, < 0.20% Nickel, <0.06% Molybdenum, <0.15% Chromium, ≤ 0.40% Silicon, < .030% Sulfur, ≤ 0.20% Copper, and other alloying elements, each less than 0.10% of the total based upon a weight percent.

Steel products under normal conditions do not present inhalation, ingestion, or contact health hazards. No regulated substances of very high concern as classified by RCRA subtitle C are used in these steel products. 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.

2.7 PROPERTIES OF DECLARED PRODUCT AS DELIVERED

The steel coil can be produced and delivered in thicknesses between 0.71 and 0.75 inches and widths of 30 to 80 inches wide, depending on thickness.

2.8 MANUFACTURING

Materials for the steel slab at each of the three facilities are comprised of primary iron mined at Cliffs' operations in Northern Minnesota and Michigan, and Hot briquetted iron (HBI), produced by Cleveland-Cliffs at their Toledo, Ohio Direct Reduction facility.

The steel coil in this study is manufactured at the Burns Harbor and Cleveland Works facilities from steel slab produced within these facilities. During the period under review, some steel slab made at Indiana Harbor/Riverdale was transferred to Cleveland Works to produce coil.

The **Cleveland Works Integrated Mill** is recognized as one of the most productive integrated facilities in the world, producing slightly more than one ton of steel per worker hour. The Cleveland Works facility comprises two blast furnaces, two steel-producing facilities with basic oxygen furnaces and continuous strand casters, 84-in hot strip mill. Out of scope operations at Cleveland Works include the pickle line, five-stand tandem mill, and hot-dip coating line (galvanize and galvanneal). Electricity and steam are produced on-site from grid electricity, natural gas, and blast furnace gas.

The **Burns Harbor Integrated Mill**, Cleveland-Cliffs' largest U.S. facility, is a fully-integrated steelmaking facility located on Lake Michigan in Northwest Indiana, 50 miles southeast of Chicago. The plant operates two blast furnaces and can produce nearly 5 million net tons of raw steel annually. Principal products made at this location are hot-rolled, cold-rolled and hot-dip galvanized products. Electricity and steam are produced on-site from grid electricity, natural gas, coke oven gas and blast furnace gas.

2.9 PACKAGING

Packaging for the steel coil is negligible and excluded.

2.10 FURTHER INFORMATION

Further information on the product can be found on the manufacturers' website at www.clevelandcliffs.com/

3. LCA: Calculation Rules

3.1 DECLARED UNIT

The declared unit used in the study is defined as one (1) metric ton of steel coil, consistent with the PCR.

Table 2. *The modules and unit processes included in the scope for the Cleveland-Cliffs steel coil. The modules are scoped by including all on-site processing at each of the steel mills in the Manufacturing (A3) module. MND = Module Not Declared.*

Module	Cleveland Works	Burns Harbor	Included in System Boundary
A1	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 iron ore mining at four mines in Northern Minnesota and one in Michigan, coal mining in Princeton, WV, direct reduced iron production (HBI) near Toledo, Ohio		✓
	Coking at Warren, OH, Monessen, PA, Burns Harbor, IN, and external	-	
A2	Transportation of raw materials (iron ore, coke) to the Cleveland Works facility	Transportation of raw materials (iron ore, coal for coking) to the Burns Harbor facility	✓
A3	Liquid iron production at the blast furnace, BOF steelmaking at the Cleveland Works mill and rolling of the final product, steel coil	Coking at Burns Harbor, Liquid iron production at the blast furnace (BF), BOF steelmaking at the steel mill and rolling of the final product, steel coil	✓
A4	Transport (to the building site)		MND
A5	Construction-installation process		MND
B1-B5	Use stage, including maintenance, repair, replacement, and refurbishment		MND
B6	Operational energy use		MND
B7	Operational water use		MND
C1	Deconstruction, demolition		MND
C2	Transport (to waste processing)		MND
C3	Waste processing		MND
C4	Disposal		MND
D	Reuse-recovery-recycling potential		MND

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 materials at facilities not owned by Cliffs were modeled using representative processes in ecoinvent, including:
    - Post-consumer scrap was modeled using ecoinvent datasets for scrap preparation.
    - Representative inventory data for raw materials and ancillary materials were modeled with unit process data taken from ecoinvent.

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- Representative inventory data were used to tailor the energy mix for electricity from the regional electricity grid. Supply mixes were modeled based on U.S. EPA eGRID 2021 for NERC subregions MROW, RFCW, and RFCE, in which the Cleveland-Cliffs operations are located.
- Where the mode of transportation for materials was unavailable, truck transportation was assumed as a conservative approach. Where the distance was unknown, the distance was either based on other materials distances or 200 miles was used as a conservative approach. These assumptions are not expected to have a significant impact on the results.
- Some water use data was not complete, having only been able to submit the withdrawals and not the discharges. Where there was primary data for two other representative processes, an average between the two was used. Where less than two other identical process data points were available, a secondary data point from ecoinvent was used.
- Approximately 5.3% of slab used in Cleveland Works coil rolling mill was produced in the Indiana Harbor BOF in 2022. While data for the Indiana Harbor blast furnace was collected and modeled, the Indiana Harbor BOF data was not collected. Riverdale BOF operations and materials were used as a proxy for the Indiana Harbor BOF.
- Disposal of manufacturing waste is modeled based on statistics for 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 and the waste disposal method was not explicit, 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.
- The PCR requires the results for several inventory flows related to construction products to be reported including energy and resource use and waste and outflows. These are aggregated inventory flows, and do not characterize any potential impact; results should be interpreted taking into account this limitation.

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 v2.0 software. For iron mining, coal mining, HBI production, coke batteries, liquid iron production, and steelmaking at Cleveland-Cliffs facilities, confidential primary data were provided by Cleveland-Cliffs. Where primary upstream data were unavailable, secondary data were used. Secondary datasets with the greatest degree of representativeness were chosen. The principal source of secondary LCI data is ecoinvent

v3.9.1 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 3 below. Primary data were provided by Cleveland-Cliffs for their Burns Harbor and Cleveland Works facilities.

Table 3. *Data sources for the Cleveland-Cliffs steel coil.*

Flow	Dataset	Data Source	Publication Date
Mining Materials			
Explosive	calcium nitrate production | ammonium nitrate | Cutoff, U – RER diesel production, petroleum refinery operation | diesel | Cutoff, U - Europe without Switzerland market for methylamine | methylamine | Cutoff, U – RER sodium nitrate production | sodium nitrate | Cutoff, U – RER market for naphtha | naphtha | Cutoff, U - RER	Ecoinvent 3.9	2022
Limestone	limestone production, crushed, washed | limestone, crushed, washed | Cutoff, U - CA-QC	Ecoinvent 3.9	2022
Bentonite	market for bentonite | bentonite | Cutoff, U - GLO	Ecoinvent 3.9	2022
calcite	market for calcium carbonate, precipitated | calcium carbonate, precipitated | Cutoff, U – RER market for maize starch | maize starch | Cutoff, U - GLO	Ecoinvent 3.9	2022
Carbon dioxide	carbon dioxide production, liquid | carbon dioxide, liquid | Cutoff, U – RER	Ecoinvent 3.9	2022
Dolomite	market for dolomite | dolomite | Cutoff, U - RER	Ecoinvent 3.9	2022
Caustic soda	market for sodium hydroxide, without water, in 50% solution state | sodium hydroxide, without water, in 50% solution state | Cutoff, U - GLO	Ecoinvent 3.9	2022
Corn starch	market for maize starch | maize starch | Cutoff, U - GLO	Ecoinvent 3.9	2022
Direct Reduced Iron Production			
Dolomitic Lime	dolomite production | dolomite | Cutoff, U – RoW	Ecoinvent 3.9	2022
Nitrogen	air separation, cryogenic | nitrogen, liquid | Cutoff, U - RER	Ecoinvent 3.9	2022
Fuels and transport, water, covered below			
Coke ovens			
External coal	hard coal mine operation and hard coal preparation | hard coal | Cutoff, U - RNA	Ecoinvent 3.9	2022
Nitrogen	air separation, cryogenic | nitrogen, liquid | Cutoff, U - RER	Ecoinvent 3.9	2022
Water	market for water, decarbonised | water, decarbonised | Cutoff, U - US	Ecoinvent 3.9	2022
Lubricating oils	lubricating oil production | lubricating oil | Cutoff, U - RER	Ecoinvent 3.9	2022
Other fuels and transport covered below			
Alloys			
Aluminums	aluminium ingot, primary, to aluminium, wrought alloy market | aluminium, wrought alloy | Cutoff, U - GLO market for aluminium, wrought alloy | aluminium, wrought alloy | Cutoff, U - GLO	Ecoinvent 3.9	2022
Boron	boron carbide production | boron carbide | Cutoff, U - GLO	Ecoinvent 3.9	2022
Silicon	market for silicon, metallurgical grade | silicon, metallurgical grade | Cutoff, U - GLO	Ecoinvent 3.9	2022
Columbium, Ferrocolumbium	market for ferroniobium, 66% Nb | ferroniobium, 66% Nb | Cutoff, U - GLO	Ecoinvent 3.9	2022
Copper	market for copper, cathode | copper, cathode | Cutoff, U – GLO	Ecoinvent 3.9	2022
Ferromanganese	ferromanganese production, high-coal, 74.5% Mn | ferromanganese, high-coal, 74.5% Mn | Cutoff, U - RoW	Ecoinvent 3.9	2022
High Carbon chromium	ferrochromium production, high-carbon, 68% Cr | ferrochromium, high-carbon, 68% Cr | Cutoff, U - RoW	Ecoinvent 3.9	2022
Low and Medium Carbon Chrome	ferrochromium production, high-carbon, 55% Cr | ferrochromium, high-carbon, 55% Cr | Cutoff, U - RoW	Ecoinvent 3.9	2022
Low Carbon Manganese	ferromanganese production, high-coal, 74.5% Mn | ferromanganese, high-coal, 74.5% Mn | Cutoff, U - RoW	Ecoinvent 3.9	2022
Manganese	manganese production | manganese | Cutoff, U - RoW	Ecoinvent 3.9	2022
Silicon manganese	magnesium oxide production | magnesium oxide | Cutoff, U - RER market for silicon, metallurgical grade | silicon, metallurgical grade | Cutoff, U - GLO	Ecoinvent 3.9	2022
Molybdenum, Ferromolybdenum	molybdenum production | molybdenum | Cutoff, U - RER	Ecoinvent 3.9	2022
Nickel	market for nickel, class 1 | nickel, class 1 | Cutoff, U - GLO	Ecoinvent 3.9	2022
Phosphorus, Ferrophosphorus	market for phosphate rock, beneficiated | phosphate rock, beneficiated | Cutoff, U - RER	Ecoinvent 3.9	2022
Sulfur	market for sulfur | sulfur | Cutoff, U - GLO	Ecoinvent 3.9	2022

Flow	Dataset	Data Source	Publication Date
Tin	tin production | tin | Cutoff, U - RoW	Ecoinvent 3.9	2022
Titanium, Ferrotitanium	market for titanium | titanium | Cutoff, U - GLO	Ecoinvent 3.9	2022
Vanadium, Ferrovanadium	vanadium-titanomagnetite mine operation and beneficiation | titania slag, 94% titanium dioxide | Cutoff, U - CN	Ecoinvent 3.9	2022
Tundish	magnesium oxide production | magnesium oxide | Cutoff, U - RER	Ecoinvent 3.9	2022
Nickel busheling	market for nickel, class 1 | nickel, class 1 | Cutoff, U – GLO, metal	Ecoinvent 3.9	2022
External Iron scrap	market for iron scrap, sorted, pressed | iron scrap, sorted, pressed | Cutoff, U - RoW	Ecoinvent 3.9	2022
Ancillary			
Calcium carbide	calcium carbide production, technical grade | calcium carbide, technical grade | Cutoff, U - RER	Ecoinvent 3.9	2022
Electrodes	market for graphite | graphite | Cutoff, U - GLO	Ecoinvent 3.9	2022
Nitrogen	air separation, cryogenic | nitrogen, liquid | Cutoff, U - RER	Ecoinvent 3.9	2022
Argon	market for argon, liquid | argon, liquid | Cutoff, U - RoW	Ecoinvent 3.9	2022
Carbon dioxide	carbon dioxide production, liquid | carbon dioxide, liquid | Cutoff, U – RER	Ecoinvent 3.9	2022
Calcium carbonate	market for calcium carbonate, precipitated | calcium carbonate, precipitated | Cutoff, U - RoW	Ecoinvent 3.9	2022
Lubricating oils	lubricating oil production | lubricating oil | Cutoff, U - RER	Ecoinvent 3.9	2022
Lime products	market for dolomite | dolomite | Cutoff, U – RER market for limestone, crushed, washed | limestone, crushed, washed | Cutoff, U – CH market for quicklime, in pieces, loose | quicklime, in pieces, loose | Cutoff, U - CH	Ecoinvent 3.9	2022
Ladle powders	Based on SDS's provided		
Refractory	market for refractory, basic, packed | refractory, basic, packed | Cutoff, U - GLO	Ecoinvent 3.9	2022
Oxygen	air separation, cryogenic | oxygen, liquid | Cutoff, U - RER	Ecoinvent 3.9	2022
Fuels (Across Operations)			
Electricity	market for electricity, medium voltage | electricity, medium voltage | Cutoff, U - US-RFC or US-MRO modified for RFCW, RFCE, MROW	Ecoinvent 3.9 eGRID 2021	2022
Natural gas	market for natural gas, high pressure | natural gas, high pressure | Cutoff, U - US	Ecoinvent 3.9	2022
Diesel	market group for diesel | diesel | Cutoff, U - GLO	Ecoinvent 3.9	2022
Gasoline	market for petrol, unleaded | petrol, unleaded | Cutoff, U - RER	Ecoinvent 3.9	2022
Propane	market for propane | propane | Cutoff, U - GLO	Ecoinvent 3.9	2022
Coal	hard coal mine operation and hard coal preparation | hard coal | Cutoff, U - RNA	Ecoinvent 3.9	2022
Transportation			
Rail	transport, freight train, diesel | transport, freight train | Cutoff, U - US	Ecoinvent 3.9	2022
Road	transport, freight, lorry 16-32 metric ton, EURO4 | transport, freight, lorry 16-32 metric ton, EURO4 | Cutoff, U - RoW	Ecoinvent 3.9	2022
Inland water transport	transport, freight, inland waterways, barge | transport, freight, inland waterways, barge | Cutoff, U - RER	Ecoinvent 3.9	2022
Waste treatment			
Landfill general	treatment of inert waste, inert material landfill | inert waste, for final disposal | Cutoff, U – RoW	Ecoinvent 3.9	2022
Incineration, nonhazardous	process-specific burdens, municipal waste incineration | process-specific burdens, municipal waste incineration | Cutoff, U - Europe without Switzerland	Ecoinvent 3.9	2022
Hazardous waste incineration	treatment of hazardous waste, hazardous waste incineration, with energy recovery | hazardous waste, for incineration | Cutoff, U - Europe without Switzerland	Ecoinvent 3.9	2022
Hazardous waste landfill	treatment of hazardous waste, underground deposit | hazardous waste, for underground deposit | Cutoff, U - RoW	Ecoinvent 3.9	2022

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 4. *Data quality assessment for the Cleveland-Cliffs 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. 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 annual production for 2022 for all of the Cleveland-Cliffs facilities with the exception of the Northshore mine and HBI production. These facilities' primary data is based on annual production for 2021 as they had been previously collected.
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 US 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 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.
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 high. Data sources of similar quality and age are used with a bias towards Ecoinvent v3.9 data where available. 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 the United States.
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 for each of the Cleveland-Cliffs 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 was collected from Cleveland-Cliffs for all of the operations for calendar year 2022, except for the Northshore mine and HBI production in Toledo, for which data represented calendar year 2021. The latter facilities used 2021 data because it had already been collected and reviewed as part of a separate LCA project. The distribution

of pellets sourced for HBI production were updated to 2022, while the operations within the HBI facility represented 2021.

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.

Allocation followed the worldsteel and EUROFER co-product guidance from 2014. Per the guidance, blast furnace slag and basic oxygen furnace slag are considered the co-products, while blast furnace dust and scale are considered by-products and not allocated any impacts. For the blast furnace and BOF processes, the slag is allocated a portion of the shared materials, resource use (e.g., electricity, natural gas, water), waste/byproducts, and emissions released, on based on the amount of energy required to produce the mass of steel and co-products. Within powerhouses, impacts from materials and emissions produced were allocated between electricity and steam generation by energy production (MJ). Blast furnace gas and coke oven gas are used for energy generation within the powerhouses at Burns Harbor and Cleveland Works.

For coke ovens which provided gas to their respective powerhouse for energy generation, i.e. Burns Harbor and Cleveland Works, the impacts of coking were allocated to coke and coke oven gas by energy content. Notably, most coke oven products contain energetic content while not all are ultimately used for energy generation.

With respect to the steel scrap, ore fines and other secondary or recycled materials, the 100-0 recycled content approach is used in which the recycled material bears only the burden of any processing from waste material.

The transportation from primary producer of material components (e.g., alloys, fluxes) to steel mill is based on primary data provided by Cleveland-Cliffs, 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, 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

Basic oxygen furnace (BOF) steelmaking and rolling occurs at Cleveland-Cliffs Burns Harbor and Cleveland Works facilities. Electricity is modeled using ecoinvent v3.9.1 for the RFC and MRO regions and modified to meet the electricity grid mix for the RFCW, RFCE, and MROW eGRID 2021 subregions, as appropriate.

For the HBI production, data was provided for the iron ore mining in Northern Minnesota and Michigan and direct reduced iron in Toledo, Ohio. Electricity at the facilities were modeled using ecoinvent v3.9.1 for MRO and RFC and modified to meet the electricity grid mix for the MROW and RFCW eGRID 2021 subregions, as applicable.

Transportation of waste materials at manufacturing assumes a 20 mile (~32 km) average distance to disposal, consistent with assumptions used in the US EPA WARM model. Assumed disposal rates for nonhazardous wastes are based on US EPA SMM rates of 20% incineration and 80% landfilled. Hazardous wastes are disposed by incineration. Recycling of steelmaking byproducts are not included by the cutoff method, while transportation to recycling facilities is based on actual modes of transport and distances, provided by the manufacturer.

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 IPCC AR5.

TRACI 2.1 Impact Category	Unit
Global Warming Potential **(GWP)**	kg CO_2 eq
Ozone Depletion Potential **(ODP)**	kg CFC 11 eq
Acidification Potential **(AP)**	kg SO_2 eq
Eutrophication Potential **(EP)**	kg N eq
Smog Formation Potential **(SFP)**	kg O_3 eq
Fossil Fuel Depletion Potential **(FFD)**	MJ Surplus, LHV

These 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.

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	kg	**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	-	-

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Table 5. *LCIA results for the declared unit of* **steel coil** *rolled at the* **Cleveland Works** *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 Material Production and Processing	A2 Transport to Manufacturer	A3 Integrated Mill and Coil Rolling	Total (A1-A3)
IPCC AR5				
Global Warming Potential (kg CO_2 eq)	579	103	1,560	2,250
	25%	5%	70%	100%
TRACI 2.1				
Global Warming Potential (kg CO_2 eq)	565	102	1,550	2,220
	25%	5%	70%	100%
Ozone Depletion Potential (kg CFC-11 eq)	$4.78x10^{-6}$	$2.05x10^{-6}$	$3.61x10^{-6}$	$1.04x10^{-5}$
	46%	20%	35%	100%
Acidification Potential (kg SO2 eq)	1.88	0.796	1.14	3.81
	49%	21%	30%	100%
Eutrophication Potential (kg N eq)	4.48	0.128	1.24	5.86
	76%	2%	21%	100%
Smog Formation Potential (kg O_3 eq)	34.1	24.9	19.7	78.7
	43%	32%	25%	100%
Fossil Fuel Depletion (MJ surplus)	758	173	1,420	2,350
	32%	7%	60%	100%

Table 6. *LCIA results for the declared unit of* **steel coil** *rolled at the* **Burns Harbor** *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 Material Production	A2 Transport to Manufacturer	A3 Integrated Mill and Coil Rolling	Total (A1-A3)
IPCC AR5				
Global Warming Potential (kg CO_2 eq)	298	62.7	1,680	2,040
	15%	3%	82%	100%
TRACI 2.1				
Global Warming Potential (kg CO_2 eq)	294	61.9	1,660	2,020
	15%	3%	82%	100%
Ozone Depletion Potential (kg CFC-11 eq)	$3.56x10^{-6}$	$1.29x10^{-6}$	$1.51x10^{-5}$	$2.00x10^{-5}$
	18%	6%	76%	100%
Acidification Potential (kg SO_2 eq)	0.804	0.471	3.03	4.30
	19%	11%	71%	100%
Eutrophication Potential (kg N eq)	1.33	$7.36x10^{-2}$	3.30	4.70
	28%	2%	70%	100%
Smog Formation Potential (kg O_3 eq)	12.2	14.7	51.6	78.5
	15%	19%	66%	100%
Fossil Fuel Depletion (MJ surplus)	451	106	1,890	2,450
	18%	4%	77%	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.

Table 7. *Resource use and waste flows per metric ton of* **steel coil** *rolled at* **Cleveland Works**, *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)	522	32.8	93.0	648
	81%	5%	14%	100%
RPRM (MJ)	0.0	0.0	0.0	0.0
	N/A	N/A	N/A	N/A
NRPRE (MJ)	5,350	1,280	10,100	16,700
	32%	8%	60%	100%
NRPRM (MJ)	8,620	0.0	0.0	8,620
	100%	0%	0%	100%
SM (MT)	0.255	0.0	0.0	0.255
	100%	0%	0%	100%
RSF/NRSF (MJ)	0.0	0.0	0.0	0.0
RE (MJ)	0.0	0.0	0.0	0.0
FW (m^3)	3.55	0.233	6.68	10.5
	34%	2%	64%	100%
Wastes				
NHWD (kg)	1.79	0.0	24.5	26.3
	7%	0%	93%	100%
HWD (kg)	4.48×10^{-2}	0.0	10.6	10.6
	0.4%	0%	99.6%	100%
HLRW (kg)	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0
ILLRW (kg)	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0
CRU (kg)	0.0	0.0	0.0	0.0
MR (kg)	4.23	0.0	31.3	35.4
	12%	0%	88%	100%
MER (kg)	0.0	0.0	0.0	0.0
EE (MJ)	0.0	0.0	0.0	0.0

Table 8. *Resource use and waste flows per metric ton of* **steel coil** *rolled at* **Burns Harbor**, *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)	293	13.0	211	517
	57%	3%	41%	100%
RPRM (MJ)	0.0	0.0	0.0	0.0
	N/A	N/A	N/A	N/A
NRPRE (MJ)	4,520	774	11,900	17,200
	26%	4%	69%	100%
NRPRM (MJ)	8,510	0.0	0.0	8,510
	0%	0%	100%	100%
SM (MT)	0.255	0.0	0.0	0.255
	100%	0%	0%	100%
RSF/NRSF (MJ)	0.0	0.0	0.0	0.0
RE (MJ)	0.0	0.0	0.0	0.0
FW (m^3)	5.11	0.136	11.3	16.6
	31%	1%	68%	100%
Wastes				
NHWD (kg)	$7.11x10^{-3}$	0.0	117	117
	0.01%	0%	100%	100%
HWD (kg)	0.464	0.0	0.640	0.644
	0.7%	0%	99.3%	100%
HLRW (kg)	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0
ILLRW (kg)	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0
CRU (kg)	0.0	0.0	0.0	0.0
MR (kg)	$5.65x10^{-3}$	0.0	72.8	72.8
	0.01%	0%	100%	100%
MER (kg)	0.0	0.0	0.0	0.0
EE (MJ)	0.0	0.0	0.0	0.0

The PCR requires the calculation of carbon emissions and removals, all of which are negligible due to the fact that no biogenic carbon is included in the product and any packaging is negligible.

6. LCA: Interpretation

The main contribution to indicator results for many of the impact category indicators assessed are during the A3 module, during BOF steelmaking and coil rolling from the electricity and natural gas use in the Blast Furnace and Basic Oxygen Furnace. The second-most impactful contributor in many cases is the Upstream Raw Materials Extraction and Processing (A1).

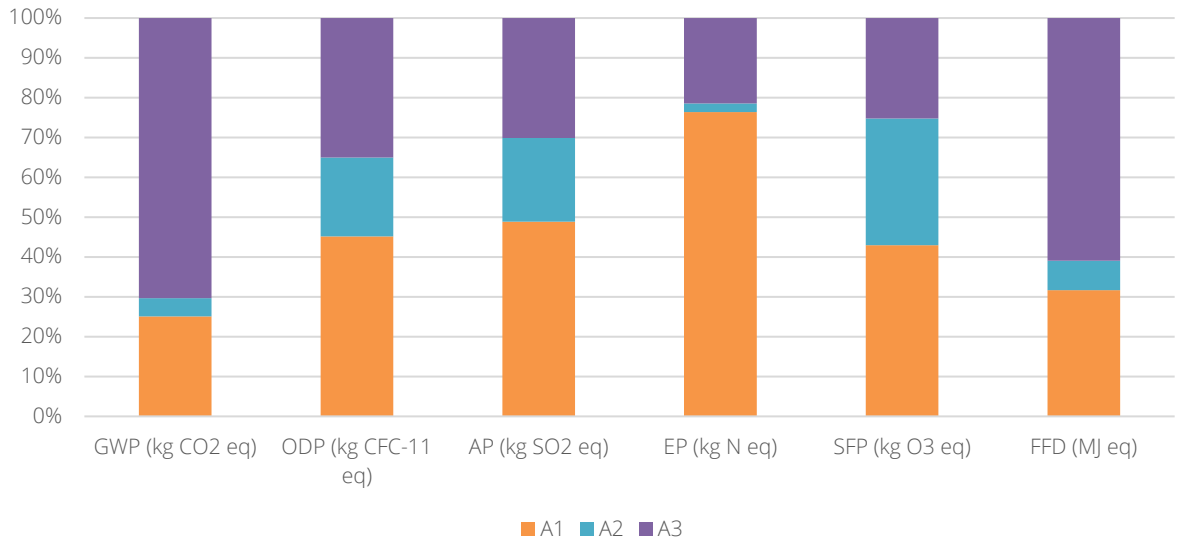

Figure 3. *Contribution analysis for Cleveland-Cliffs steel coil, hot rolled at Cleveland Works (TRACI 2.1).*

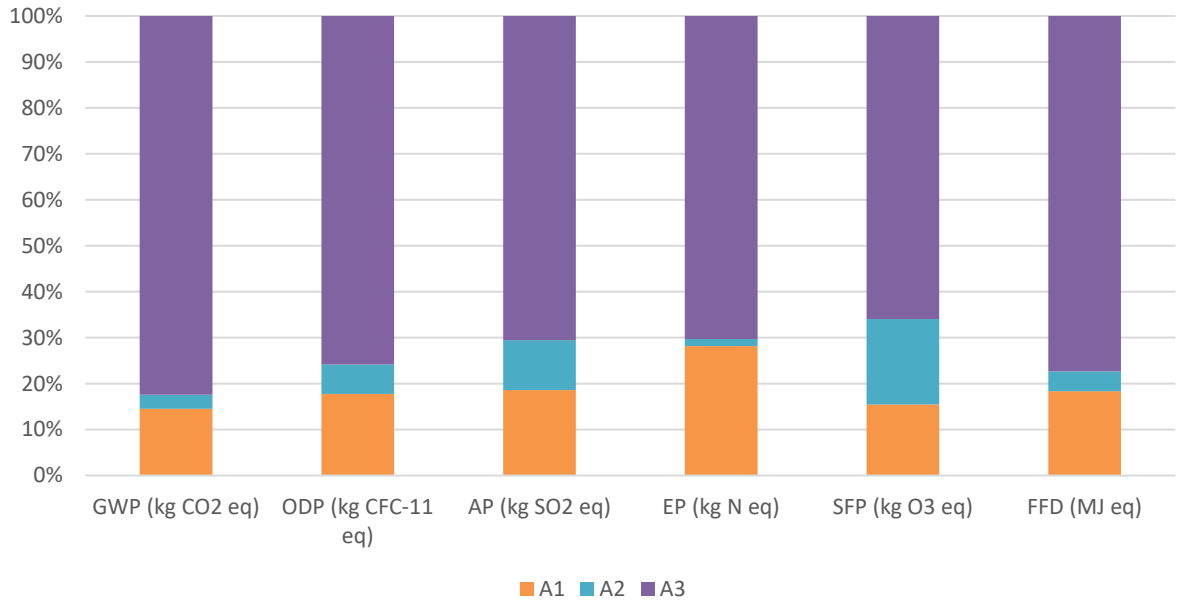

Figure 4. *Contribution analysis for Cleveland-Cliffs steel coil, hot rolled at Burns Harbor (TRACI 2.1).*

Limitations

Primary data of material components (i.e., alloys, refractory materials) could not be modeled with actual process information and ecoinvent datasets were used to represent the alloy materials.

This facility also produces other grades of steel, and facility energy use and waste data could not be disaggregated between different grades of coil.

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