ENVIRONMENTAL PRODUCT DECLARATION

HOLLOW STRUCTURAL SECTIONS

NUCOR TUBULAR PRODUCTS – A NUCOR COMPANY

NUCOR®

TUBULAR PRODUCTS

Nucor Corporation (Nucor) is North America's most diversified steel and steel products company specializing in a wide variety of products, including hollow structural sections (HSS) produced at Nucor Tubular Products (NTP) facilities.

Nucor HSS products are manufactured at five (5) NTP facilities in Birmingham, AL; Chicago, IL; Decatur, AL; Marseilles, IL; and Trinity, AL. All HSS produced in these facilities is made from steel which is melted and rolled in the United States and sourced from Nucor Electric Arc Furnace (EAF) steel mills. Nucor is North America's largest recycler, recycling approximately 20.8 million net tons of steel scrap into new steel in 2023.

Nucor uses EAF technology at each of its steel production facilities. The EAF process utilizes post-consumer scrap as its major feedstock, unlike traditional blast furnace steelmaking which produces more than 70% of the world's steel using mined iron ore and metallurgical coal as feedstock. As a result, the recycled content of HSS from Nucor facilities is greater than that of the HSS sourced from blast furnace steel. In 2023, the recycled content of Nucor products was 77.0% on average.

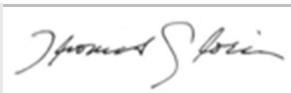
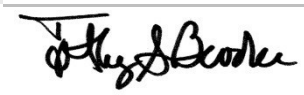
ENVIRONMENTAL PRODUCT DECLARATION

NUCOR
TUBULAR PRODUCTS

Hollow Structural Sections
Designated Steel Construction Product

According to ISO 14025, and ISO 21930:2017

EPD PROGRAM AND PROGRAM OPERATOR NAME, ADDRESS, LOGO, AND WEBSITE	**ASTM INTERNATIONAL** 100 BARR HARBOR DRIVE, P.O. BOX C700 WEST CONSHOHOCKEN, PA 19428-2959, USA HTTPS://ASTM.ORG
GENERAL PROGRAM INSTRUCTIONS AND VERSION NUMBER	ASTM Program Operator for Product Category Rules (PCR) and Environmental Product Declarations (EPDs), General Program Instructions, Version: 8.0, Revised 04/29/20.
MANUFACTURER NAME AND ADDRESS	Nucor Corporation, 1915 Rexford Road, Charlotte, North Carolina 28211
DECLARATION NUMBER	765
DECLARED PRODUCT & FUNCTIONAL UNIT OR DECLARED UNIT	Hollow Structural Sections (HSS), 1 metric ton
REFERENCE PCR AND VERSION NUMBER	Part A: Life Cycle Assessment Calculation Rules and Report Requirements (UL Environment, V4.0, 3.28.2022) and Part B: Designated Steel Construction Product EPD Requirements (UL Environment, V2.0, 08.26.2020).
DESCRIPTION OF PRODUCT APPLICATION/USE	Hollow Structural Sections (HSS) used in construction
PRODUCT RSL DESCRIPTION (IF APPL.)	N/A
MARKETS OF APPLICABILITY	North America
DATE OF ISSUE	August 26, 2024
PERIOD OF VALIDITY	5 years
EPD TYPE	Product-Specific
EPD SCOPE	Cradle to Gate
YEAR(S) OF REPORTED PRIMARY DATA	2022
LCA SOFTWARE & VERSION NUMBER	LCA for Experts v10.7.0.183
LCI DATABASE(S) & VERSION NUMBER	LCA for Experts 2023.1
LCIA METHODOLOGY & VERSION NUMBER	TRACI 2.1, IPCC 2013 (AR5)

The PCR review was conducted by:	 Dr. Tom Gloria, Chair, Industrial Ecology Associates
This declaration was independently verified in accordance with ISO 14025: 2006. ☐ INTERNAL ☒EXTERNAL	 Tim Brooke, ASTM International
This life cycle assessment was conducted in accordance with ISO 14044 and the reference PCR by:	Trinity Consultants
This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by:	 Lindita Bushi, PhD., Athena Sustainable Materials Institute

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

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: 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.

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.

This declaration was independently verified in accordance with ISO 14025: 2006. The UL Environment "Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Project Report," v4.0 (March 2022), in conformance with ISO 21930:2017, serves as the core PCR, with additional considerations from the USGBC/UL Environment Part A Enhancement (2017).

1. PRODUCT DEFINITION AND INFORMATION

Description of Organization

This environmental product declaration (EPD) represents hollow structural sections (HSS) produced by Nucor HSS Facilities located in Birmingham, AL; Chicago, IL; Decatur, AL; Marseilles, IL; and Trinity, AL. As a vertically integrated company, Nucor controls a large and growing part of its supply chain from scrap recycling to raw steelmaking to steel products and distribution. Nucor HSS products are formed from hot-rolled or galvanized steel coil products. All steel produced by Nucor is 100% recyclable at the end of its useful life.

For production of the raw steel used in Nucor's steel mills, Nucor uses scrap as its primary feedstock, which is largely provided by its wholly owned subsidiary, the David J. Joseph Company (DJJ). DJJ operates more than 60 scrap recycling facilities within close proximity to Nucor steel mills, processing approximately 5,000,000 tons of ferrous scrap annually and providing an abundant supply of scrap to the steel mills. Having an abundant and reliable supply of recycled scrap within close proximity not only gives Nucor's steel mills a logistics and economic advantage over their competitors, but also a carbon footprint that is a fraction of the average steel producer.

Product Description

HSS are high-strength welded carbon steel tubes used as structural elements in building and bridge construction as well as a wide variety of manufactured products. HSS products in this EPD represent products manufactured in the United States from steel produced in the United States.

HSS products can be provided in a range of sizes, wall thicknesses, and shapes. HSS products are defined by the following standards:

- A588
- ASTM A500 Grade B and C
- ASTM 252
- ASTM 1085
- ASTM 513
- ASTM A53 ERW Grade B
- ASTM 135
- ASTM A795

Once HSS is manufactured, it may be transported to a fabricator where it can be detailed, cut, drilled, bolted, welded, and otherwise processed at the fabricator in order to prepare them for installation. This EPD reports the LCA results of unfabricated HSS and fabricated HSS separately.

Product Composition

Steel is an alloy of iron containing small amounts of manganese, silicon, chromium, nickel, aluminum, copper, and trace alloys. These alloying elements improve the chemical and physical properties of steel, such as strength, ductility, durability, and corrosion resistance. There are many different grades of steel with many different physical, chemical, and environmental properties. Composition data for the studied product can be found in the table below. Various grades of steel will contain different combinations of these elements and/or trace materials. Exact specifications may be found by calling the division and asking for a specifications sheet.

Table 1. Composition Data for Steel Product[1]

NAME	MAX VALUE	UNIT
Manganese	<1.7	% by mass
Phosphorus	<0.15	% by mass
Sulfur	<0.35	% by mass
Columbium	<0.10	% by mass
Vanadium	<0.20	% by mass
Aluminum	<0.10	% by mass
Copper	0.2-0.6	% by mass
Iron	Balance	% by mass

Product Average

The 2022 production data used in this EPD considers HSS produced by Nucor Tubular Products during the year. The products are manufactured at five locations in the US. Results are weighted according to production totals at all five locations. Facility-specific global warming potential results are provided in a separate table.

Application

HSS are high-strength welded carbon steel tubes used as structural elements in building and bridge construction as well as a wide variety of manufactured products. HSS has a high strength to weight ratio, excellent compression support characteristics and excellent torsional resistance. When engineered and fabricated properly, it outperforms other material choices at a lower weight. In exposed applications, HSS is an exciting, visual part of the design of buildings, bridges and other structures. HSS provides uniformity of size, shape, strength and tolerances that make its use totally predictable. HSS can be readily bent, formed, punched and drilled.

Declaration of Methodological Framework

The scope of the EPD is cradle-to-gate, including raw material extraction and processing, upstream transportation, and product manufacture (Modules A1, A2, and A3).

Technical Requirement

Technical data for the studied product can be found in the table below.

[1] https://www.nucortubular.com/wp-content/uploads/2017/01/SafetyDataSheetHSS_500-1.pdf

Table 2. Technical data for steel product

NAME	VALUE	UNIT
Density	7,800	kg/m^3
Melting point	1425-1450	°C
Electrical conductivity at 20°C	NA	% of IAC[8]
Thermal conductivity	NA	W/(m-K)
Coefficient of thermal expansion	NA	m/m-ºC
Modulus of elasticity	NA	N/mm^2
Shear modulus	NA	N/mm^2
Specific heat capacity	NA	J/kg-ºC
Hardness, Brinell Number	80-100	HB
Yield strength	250-550	N/mm^2
Ultimate tensile strength	410-655	N/mm^2
Breaking elongation	13-20	%
Chemical composition	Varies by ASTM Specification/Grade	% by mass

Properties of Declared Product as Delivered

HSS products can be provided in a range of sizes, wall thicknesses, and shapes. Across Nucor's facilities located at Birmingham, Chicago, Decatur, Marseilles, and Trinity, Nucor offers an extensive selection of round, square, and rectangular tubing. Round tubing sizes range from approximately 1.050" OD with a 0.083" wall thickness up to 18.000" OD with a 0.625" wall thickness. Square tubing is available from around 1 1/2" with a 0.109" wall thickness up to 14" with a 0.625" wall thickness. Please note that other sizes may be available. These diverse size ranges and wall thicknesses ensure that Nucor can supply the right HSS products for applications ranging from light structural use to heavy-duty industrial projects, ensuring robust and reliable performance across different sectors.

Material Composition

Nucor HSS is manufactured from sheet steel produced through an electric arc furnace whose largest component is recycled scrap steel. The product does not include materials or substances which may have any potential route of exposure to humans or flora/fauna in the environment. The product does not contain any hazardous substances according to the Resource Conservation and Recovery Act (RCRA), Subtitle 3. The products do not release dangerous substances to the environment, including indoor air emissions, gamma or ionizing radiation, or chemicals released to air or leached to water and soil.

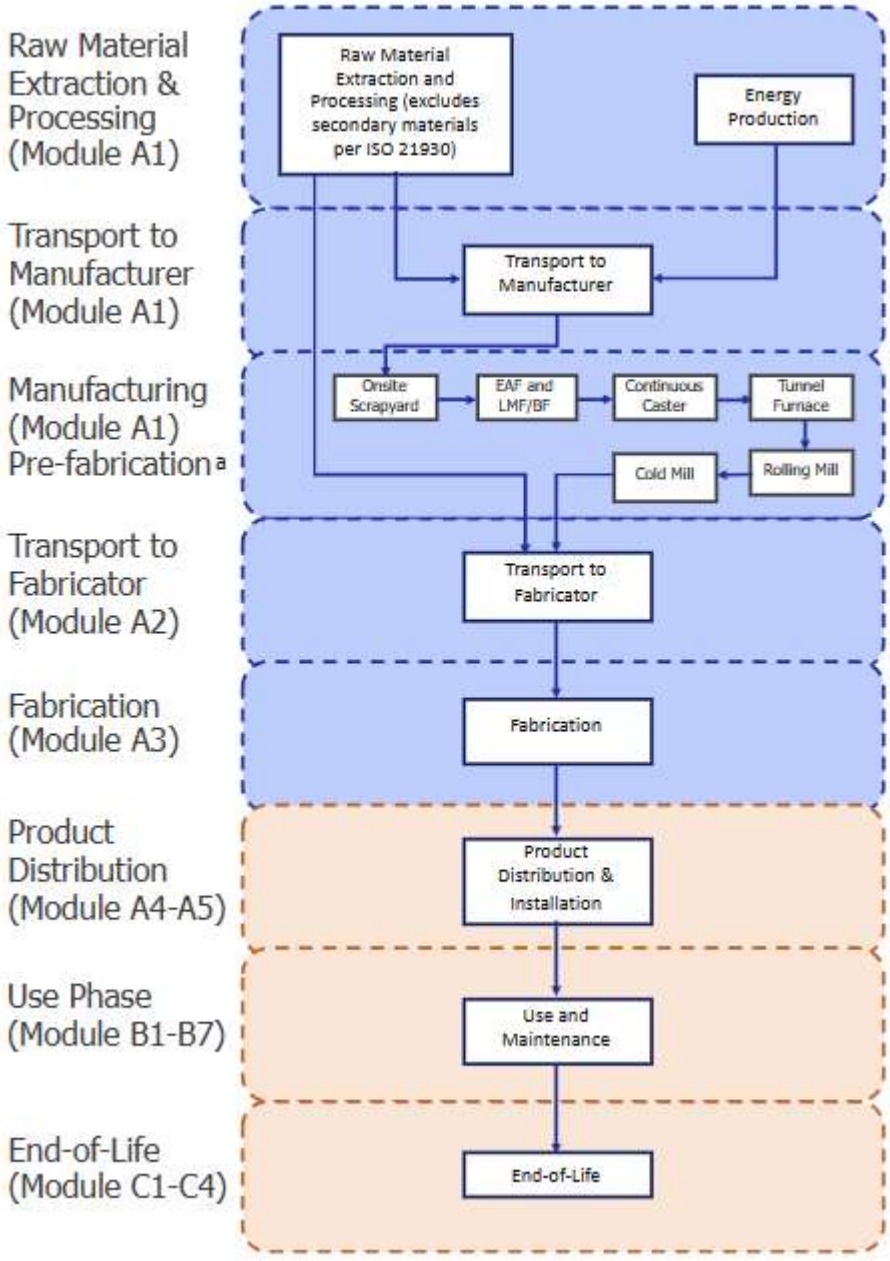
Manufacturing

The Nucor HSS facilities are steel manufacturing facilities that utilize steel coil sourced from Nucor steel mills to form hollow structural sections. Steel coil products are received from steel mills via barge, truck, and rail and added to onsite material inventory. The coils are inspected to ensure that the proper chemical and mechanical properties meet Nucor specifications. The coils are slit to smaller width, unwound, and shaped into round tubes. The round tubes then enter the electric resistance welding station, where the tube's edges are heated and rolls apply extreme pressure to hold the tube's seams in place. During this process, excess material and impurities are forced out of the tube and removed using a carbide cutting tool. The welded round tube is cooled and lubricated before heading to the sizing section. In the sizing section, the tube is further worked to ensure consistent roundness. The round tube may be shaped into square or rectangular tubes. The resulting product may be round, rectangular, or square tubes that are cut to length, stenciled, and packaged for sale.

The life cycle phases included in this study are illustrated in Figure 1.

Packaging

Lumber and plastic packaging at Nucor HSS Facilities are included in the LCA for this EPD.



* Processes outlined in Fabrication (Module A3) are specific to Nucor HSS facilities. Individual processes will vary between other facilities.

Figure 1: Flow chart for product system

2. LCA CALCULATION RULES

Declared Unit

The declared unit is one (1) metric ton of HSS product.

System Boundary

Per the PCR, this cradle-to-gate analysis provides information on the Product Stage of the steel product life cycle, including modules A1, A2, and A3. Product delivery, installation and use, and product disposal (modules A4 – A5, B1 – B7, C1 – C4, and D) have not been included.

PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARY
Raw material supply	Transport	Manufacturing	Transport from gate to site	Assembly/Install	Use	Maintenance	Repair	Replacement	Refurbishment	Building Operational Energy Use During Product Use	Building Operational Water Use During Product Use	Deconstruction	Transport	Waste processing	Disposal	Reuse, Recovery, Recycling Potential
A1	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND

X = Module declared
MND = Module not declared

Cut-off Rules

According to the PCR, processes contributing greater than 1% of the total environmental impact indicator for each impact are included in the inventory. In cases where no matching life cycle inventories were available to represent a flow, proxy data were applied based on conservative assumptions regarding environmental impacts. No data gaps were allowed which were expected to significantly affect the outcome of the indicator results. No other known flows are deliberately excluded from this EPD.

The mass input of each omitted stream is less than 1% of the total mass input streams into the system and the cumulative mass input of all omitted streams is less than 5% of the total mass input streams. Therefore, no data gaps were allowed which were expected to significantly affect the outcome of the indicator results.

Data Sources

The LCA model was created using the LCA for Experts (formerly GaBi) Software system for life cycle engineering, version 10.7.0.183, developed by Sphera. Background life cycle inventory data for raw materials and processes were obtained from the Managed LCA Content (formerly known as GaBi databases). Primary manufacturing data were provided by Nucor.

The HSS facilities manufacture unfabricated HSS. Once unfabricated HSS is manufactured, it may be transported to a fabricator where it can be detailed, cut, drilled, bolted, welded, and otherwise processed at the fabricator in order to prepare them for

installation. For fabricated HSS results, Module A2 (transport to the fabrication site) and Module A3 (fabrication) impact results are taken from the AISC industry-average EPD for HSS, located here: https://www.aisc.org/globalassets/why-steel/aisc_epd_fab-hss.pdf.

Data Quality

A variety of tests and checks were performed by the LCA practitioner throughout the project to ensure high quality of the completed LCA. Checks included an extensive review of project specific LCA models as well as the background data used.

Production data has been collected by Nucor directly from the production sites and are average values for the year 2022 (12 consecutive months of averaged data as required for manufacturer specific data sets). The data has been measured and verified internally. The data is assumed to be the most relevant according to current conditions and production practices. Based on availability of data, natural gas, and electricity usage for the operation of administrative offices was included in the system boundary for some facilities.

Time-related coverage, geographical coverage, technological coverage, precision, completeness, representativeness, consistency, reproducibility, sources of data, and uncertainty have each been analyzed as part of this LCA. All inputs and data sources meet the requirements set forth in the PCR and there is no reason to believe that any of the employed material, data, or inputs are not representative of the product under study.

Geographical Coverage

Primary data represents production in the United States at the following Nucor facilities:

- Nucor Tubular Products – Birmingham, AL
- Nucor Tubular Products – Chicago, IL
- Nucor Tubular Products – Decatur, AL
- Nucor Tubular Products – Trinity, AL
- Nucor Tubular Products – Marseilles, IL

Regionally specific datasets, where available, were used to represent each manufacturing location's energy consumption. Proxy datasets were used as needed for raw material inputs to address lack of data for a specific material or for a specific geographical region. These proxy datasets were chosen for their technological representativeness of the actual materials.

Period under Review

Primary data collected represent production during the 2022 calendar year. This analysis is intended to represent production in 2022.

Allocation

Per ISO 21930 and the PCR, this is an attributional LCA and as such, no allocation using system expansion was performed. Allocation of background data (energy and materials) taken from the Managed LCA Content (formerly known as GaBi databases) is documented online at https://sphera.com/life-cycle-assessment-lca-database/. No multi-output allocation was performed or required in the foreground system of the study.

Estimates and Assumptions

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

All the raw materials and energy inputs have been modeled using processes and flows that closely follow actual production data on raw materials and processes. All the reported material and energy flows have been accounted for.

Raw Material procurement and upstream transport to Nucor HSS facilities are included for all raw materials above the cut-off thresholds. For each raw material, a representative dataset was selected to represent the geographic region of origin. Distances

by truck and rail were estimated using Google Maps. In some cases, the Nucor HSS facilities sourced a single raw material from multiple distributors, in which case the transport from every distributor was modeled. Only travel to the facility is accounted for (i.e., return truck and rail trips are considered out of scope).

3. LCA RESULTS

North American life cycle impact assessment (LCIA) results are declared using TRACI 2.1 methodology, with the exception of GWP which uses the IPCC 2013 (AR5) methodology and ADP_{fossil} which uses CML-baseline v4.7 August 2016 per the PCR Part A Section 4.7. LCIA results are relative expressions and do not predict actual impacts, the exceeding of thresholds, safety margins or risks.

The six impact categories reported in the LCIA tables below 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.

Any comparison of EPDs shall be subject to the requirements of ISO 21930. Environmental impact results shall be converted to a functional unit basis before any comparison is attempted. 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.

To align with the PCR, product specific EPDs which include averaging shall report the range of results for all IPCC AR5 and TRACI indicators for products included in the average. Averaging across manufacturing facilities was used in this EPD, so Table 6 and Table 10 report the range of results for the six impact categories included in Table 3 and Table 7.

Steel HSS Unfabricated Product Results

Table 3. LCIA results, per 1 metric ton of unfabricated product [a]

PARAMETER	UNIT	A1	A2	A3	TOTAL
GWP 100	kg CO_2 eq.	1.13E+03	8.62E+00	3.14E+01	1.17E+03
ODP	kg CFC 11 eq.	1.31E-07	2.42E-14	1.65E-11	1.31E-07
AP	kg SO_2 eq.	3.71E+00	4.94E-02	6.86E-02	3.83E+00
EP	kg N eq.	1.85E-01	4.12E-03	4.50E-03	1.93E-01
SFP	kg O_3 eq.	6.32E+01	1.50E+00	9.50E-01	6.56E+01
ADP_{FOSSIL}	MJ surplus	1.41E+04	1.21E+02	4.10E+02	1.46E+04

a. Results represent a production-weighted average of the five Nucor HSS facilities.

Table 4. Resource use results, per 1 metric ton of unfabricated product [a,b]

PARAMETER	UNIT	A1	A2	A3	TOTAL
RPR_E	MJ LHV	8.04E+02	4.90E+00	1.09E+02	9.19E+02
RPR_M	MJ LHV	0.00E+00	0.00E+00	0.00E+00	0.00E+00
$NRPR_E$	MJ LHV	1.55E+04	1.22E+02	5.24E+02	1.61E+04
$NRPR_M$	MJ LHV	6.84E+02	0.00E+00	0.00E+00	6.84E+02
SM	kg	8.35E+02	0.00E+00	0.00E+00	8.35E+02
RSF	MJ LHV	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ LHV	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RE	MJ LHV	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	m^3	4.90E+00	1.67E-02	4.42E-01	5.36E+00

a. Lower calorific values (LHV) of fuels are used for energy parameters.
b. Results represent a production-weighted average of the five Nucor HSS facilities.

Table 5. Output flows and waste categories results, per 1 metric ton of unfabricated product [a,b]

PARAMETER	UNIT	A1	A2	A3	Total
HWD	kg	2.54E+01	0.00E+00	0.00E+00	2.54E+01
NHWD	kg	3.63E+01	0.00E+00	1.01E+00	3.73E+01
HLRW	kg	9.37E-04	4.35E-07	4.79E-05	9.85E-04
ILLRW	kg	7.86E-01	3.66E-04	4.01E-02	8.26E-01
CRU	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MR	kg	5.21E+01	0.00E+00	1.11E-04	5.21E+01
MER	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EE	MJ LHV	0.00E+00	0.00E+00	0.00E+00	0.00E+00

a. Lower calorific values (LHV) of fuels are used for energy parameters.
b. Results represent a production-weighted average of the five Nucor HSS facilities.

Table 6. LCIA results, variation per 1 metric ton of unfabricated product [a]

PARAMETER	UNIT	A1 (MIN)	A1 (MAX)	A2 (MIN)	A2 (MAX)	A3 (MIN)	A3 (MAX)	TOTAL (MIN)	TOTAL (MAX)
GWP 100	kg CO_2 eq.	1.10E+03	1.16E+03	2.59E-01	2.46E+01	1.96E+01	4.37E+01	1.12E+03	1.22E+03
ODP	kg CFC 11 eq.	3.53E-08	3.54E-07	1.20E-15	6.58E-14	4.28E-12	2.73E-11	3.53E-08	3.54E-07
AP	kg SO_2 eq.	3.58E+00	3.95E+00	1.61E-03	9.71E-02	3.33E-02	9.04E-02	3.71E+00	4.02E+00
EP	kg N eq.	1.76E-01	1.88E-01	1.32E-04	9.00E-03	2.12E-03	7.87E-03	1.79E-01	2.02E-01
SFP	kg O_3 eq.	6.15E+01	6.53E+01	4.79E-02	3.10E+00	5.53E-01	1.57E+00	6.41E+01	6.71E+01
ADP_{FOSSIL}	MJ surplus	1.24E+04	1.51E+04	3.62E+00	3.42E+02	2.61E+02	5.81E+02	1.27E+04	1.56E+04

a. Results compared based on 1 metric ton of unfabricated product produced by each facility.

Steel HSS Fabricated Product Results

Table 7. LCIA results, per 1 metric ton of fabricated product [a]

PARAMETER	UNIT	A1	A2	A3	TOTAL
GWP 100	kg CO_2 eq.	1.26E+03	4.46E+01	9.67E+01	1.40E+03
ODP	kg CFC 11 eq.	1.41E-07	8.67E-14	1.62E-09	1.43E-07
AP	kg SO_2 eq.	4.12E+00	1.83E-01	1.52E-01	4.46E+00
EP	kg N eq.	2.08E-01	1.64E-02	1.23E-02	2.37E-01
SFP	kg O_3 eq.	7.07E+01	4.44E+00	2.23E+00	7.73E+01
ADP_{FOSSIL}	MJ surplus	1.57E+04	7.16E+01	1.04E+02	1.59E+04

a. Results represent a production-weighted average of the five Nucor HSS facilities for A1 and the AISC Industry average for A2 and A3.

Table 8. Resource use results, per 1 metric ton of fabricated product [a,b]

PARAMETER	UNIT	A1	A2	A3	TOTAL
RPR_E	MJ LHV	9.90E+02	6.24E+01	2.16E+02	1.27E+03

RPR_M	MJ LHV	0.00E+00	0.00E+00	0.00E+00	0.00E+00
$NRPR_E$	MJ LHV	1.74E+04	6.91E+02	1.47E+03	1.95E+04
$NRPR_M$	MJ LHV	7.37E+02	0.00E+00	1.26E+01	7.50E+02
SM	kg	9.00E+02	0.00E+00	7.52E-01	9.00E+02
RSF	MJ LHV	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ LHV	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RE	MJ LHV	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	m^3	5.77E+00	1.81E-01	6.82E-01	6.63E+00

a. Lower calorific values (LHV) of fuels are used for energy parameters.
b. Results represent a production-weighted average of the five Nucor HSS facilities for A1 and the AISC Industry average for A2 and A3.

Table 9. Output flows and waste categories results, per 1 metric ton of fabricated product [a,b]

PARAMETER	UNIT	A1	A2	A3	Total
HWD	kg	2.74E+01	0.00E+00	3.32E-01	2.77E+01
NHWD	kg	4.02E+01	0.00E+00	9.66E+00	4.98E+01
HLRW	kg	1.06E-03	3.16E-05	1.18E-04	1.21E-03
ILLRW	kg	8.90E-01	2.64E-02	9.85E-02	1.02E+00
CRU	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MR	kg	5.62E+01	0.00E+00	7.71E+01	1.33E+02
MER	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EE	MJ LHV	0.00E+00	0.00E+00	0.00E+00	0.00E+00

a. Lower calorific values (LHV) of fuels are used for energy parameters.
b. Results represent a production-weighted average of the five Nucor HSS facilities for A1 and the AISC Industry average for A2 and A3.

Table 10. LCIA results, variation per 1 metric ton of fabricated product [a]

PARAMETER	UNIT	A1 (MIN)	A1 (MAX)	A2 (MIN)	A2 (MAX)	A3 (MIN)	A3 (MAX)	TOTAL (MIN)	TOTAL (MAX)
GWP 100	kg CO_2 eq.	1.21E+03	1.31E+03	4.46E+01	4.46E+01	9.67E+01	9.67E+01	1.35E+03	1.45E+03
ODP	kg CFC 11 eq.	3.81E-08	3.81E-07	8.67E-14	8.67E-14	1.62E-09	1.62E-09	3.97E-08	3.83E-07
AP	kg SO_2 eq.	4.00E+00	4.33E+00	1.83E-01	1.83E-01	1.52E-01	1.52E-01	4.34E+00	4.67E+00
EP	kg N eq.	1.93E-01	2.17E-01	1.64E-02	1.64E-02	1.23E-02	1.23E-02	2.21E-01	2.46E-01
SFP	kg O_3 eq.	6.91E+01	7.22E+01	4.44E+00	4.44E+00	2.23E+00	2.23E+00	7.57E+01	7.89E+01
ADP_{FOSSIL}	MJ surplus	1.37E+04	1.68E+04	7.16E+01	7.16E+01	1.04E+02	1.04E+02	1.38E+04	1.70E+04

a. Results compared based on 1 metric ton of fabricated product produced by each facility.

4. LCA INTERPRETATION

In order to facilitate a more detailed understanding of the contributions from different mill processes, an analysis is included in this section which details the contribution from Modules A1, A2, and A3. The results in Figure 3 are shown below for unfabricated HSS steel products – these facilitate a better understanding of which categories contribute most to which impacts.

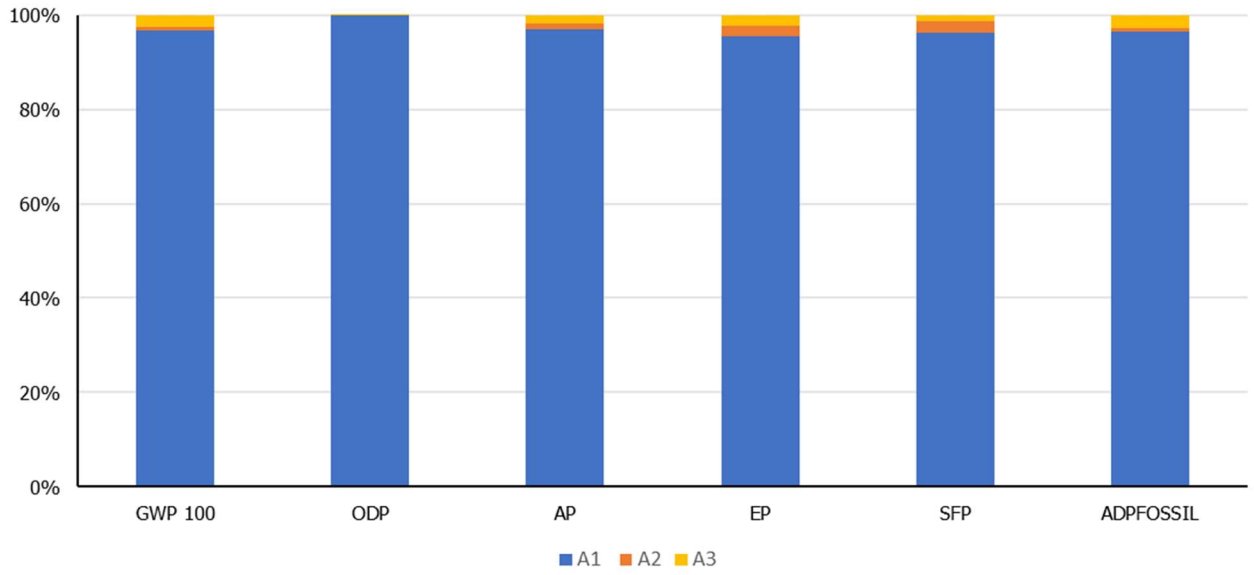


Figure 2: Relative contributions by module, IPCC AR5 + TRACI 2.1 impact categories

Overall, Module A1, i.e., manufacturing of raw materials and coil products, is the key contributor to most potential environmental impacts, including global warming potential, ozone depletion potential, acidification potential, smog formation potential, eutrophication potential, and abiotic resource depletion potential of fossil energy resources. Module A2 (transport to the HSS site) and Module A3 (manufacturing at the HSS site) are not a significant contributor in any impact category.

Facility-Specific GWP 100 Results

Nucor HSS is manufactured at five different facilities. The results presented in the LCA Results section above represent a production-weighted average of these facilities. To understand how the GWP table may vary between sites, facility specific GWP 100 results are presented below, per metric ton.

Table 11. Facility-specific GWP 100 results, per 1 metric ton of unfabricated product

GWP 100 (kg CO_2 eq.)	A1	A2	A3	TOTAL
Birmingham, AL	1.15E+03	2.46E+01	4.37E+01	1.22E+03
Chicago, IL	1.11E+03	8.19E-01	1.96E+01	1.13E+03
Decatur, AL	1.10E+03	2.59E-01	2.01E+01	1.12E+03
Trinity, AL	1.16E+03	1.08E+00	4.06E+01	1.20E+03
Marseilles, IL	1.14E+03	1.05E+01	3.25E+01	1.18E+03

Table 12. Facility-specific GWP 100 results, per 1 metric ton of fabricated product

GWP 100 (kg CO_2 eq.)	A1	A2	A3	TOTAL
Birmingham, AL	1.31E+03	4.46E+01	9.67E+01	1.45E+03
Chicago, IL	1.22E+03	4.46E+01	9.67E+01	1.36E+03
Decatur, AL	1.21E+03	4.46E+01	9.67E+01	1.35E+03
Trinity, AL	1.29E+03	4.46E+01	9.67E+01	1.43E+03
Marseilles, IL	1.27E+03	4.46E+01	9.67E+01	1.42E+03

5. ADDITIONAL ENVIRONMENTAL INFORMATION

Health and Safety

Health: Refer to the specific Nucor product SDS for health, safety, and proper handling information.[2]

Safety: Nucor's top priority is to become the safest steel company in the world. This is accomplished through the empowerment of each and every teammate to hold one another accountable to work safely. In 2020, Nucor had its best safety performance in company history. At Nucor, nothing is more important than our teammates returning home safely to their families after each and every shift.

Environmental Activities and Certifications

ISO 14001:2015 Environmental Management System: The environmental performance of Nucor's steel mills focuses on continuous improvement through internal and external training, application of new technologies and how data and results are communicated. To provide a framework for Nucor teammates to follow, Nucor utilizes ISO 14001, which is the international standard that establishes specific requirements for an effective environmental management system (EMS).

Sustainability: For more than 50 years, Nucor has been making steel using an electric arc furnace (EAF) that melts recycled scrap and turns it into new steel. EAFs are far less energy intensive and more energy efficient than traditional blast furnace steel making. Electric arc furnaces allow Nucor to produce less emissions than competitors who often make steel by melting iron ore and coking coal.

By recycling scrap in EAFs, Nucor's energy intensity (average gigajoules per metric ton of steel produced) is 74% lower than the global average, and its greenhouse gas intensity (metric tons CO2 per ton of steel produced) is less than one-fourth the global average, and nearly one-fifth of the average integrated (BF/BOF) steel producer. Today, Nucor's greenhouse gas emissions intensity is less than one-third of the Paris Climate Agreement's most aggressive 2030 target for the global steel sector, the below 2 degrees Celsius benchmark compared to pre-industrial levels.

Currently, Nucor accounts for more than 25% of the United States' steel production, but only accounts for 8% of the domestic steel industry's greenhouse gas emissions. Nucor is also committing to a 35% combined reduction in its steel mill Scope 1 and Scope 2 greenhouse gas intensity by 2030, measured against a 2015 baseline. This goal will take Nucor's steel mill CO2 emissions down to 77% less than today's global steelmaking average, and 82% less than today's integrated steelmaking average. Beyond 2030, Nucor is committed to further reducing its greenhouse emissions to a goal of net zero emission steel at scale.

Recycled Materials Content: Nucor uses recycled scrap to make high-quality steel with low emissions. Nationwide, in 2023 Nucor steel products were made from an average of 77.0% recycled content, with some products containing almost 100% recycled content. Nucor facilities use Nucor steel products for over 99% of their steel raw materials.

Globally, only 26.3% of the more than 2 billion net tons of steel produced in 2020 was made by recycling scrap in EAFs. Scrap inputs for the total crude steel production globally have remained at around 35% since 2013.

Waste and Water Recycling: Nucor's EAFs, including the ones at its sheet steel mills, emit less than 1% of the particulate matter of a traditional steel blast furnace – and the company recycles 99% of the EAF dust it collects in its baghouses. Nucor also recognizes that water is a critical natural resource and is essential to Nucor and the communities in which it operates. Nucor has worked extensively to improve water use efficiency in its processes. Currently there are no Nucor steel mill divisions located

[2] https://assets.ctfassets.net/aax1cfbwhqog/UcLHwfmcRVoyrpxb15vZl/c73a00f2a213af726e2ef74584c79517/SDS-Bar_Steel.pdf

in a High or Extremely High Water Stress Area.

Nucor also participates in the Network for Business Innovation and Sustainability (NBIS) By-Product Synergy Group. This NBIS group brings together environmental experts from a wide variety of industries to allow them to compare waste streams and find ways to divert materials from landfills.

Clean Energy: Nucor is increasing its utilization of renewable energy and supporting the continued growth of clean power generation in the United States. In addition, in November 2020 and March 2021, Nucor entered two Virtual Power Purchase Agreements (VPPAs) which support the development of more than 350 megawatts of new clean energy infrastructure.

The VPPAs enable the construction of 250MW of new solar energy and 100MW of new wind energy in Texas. Together, these two projects are equal to the electricity usage of nearly 70,000 Texas homes and have the potential to supply renewable power to the regional electric grid 24-hours a day.

Environmental Training: In 2015, Nucor established Nucor Environmental University (NEU), an online training platform for Nucor teammates with environmental responsibilities and others looking to expand their involvement with the environmental team. From the beginning, Nucor designed this program to help teammates develop a thorough and meaningful understanding of environmental compliance. NEU has had over 1,000 active users since its inception and Nucor teammates have completed at least 10,000 environmental training courses, passed over 6,600 training exams, and helped develop dozens of courses. Because of NEU, Nucor’s teammates are better prepared to meet the demands of environmental compliance and achieve Nucor’s goal of being a sustainable organization.

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