Environmental Product Declaration | Midvalley Rebar
Fabricated Steel Reinforcing Bar

Declaration Owner
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Products
Fabricated steel reinforcing bar (rebar)
(ASTM A615, A706)

Declared Unit
The declared unit is one metric ton of fabricated reinforcing bar.
Results are reported using SI units.

This EPD represents reinforcing bar produced via the electric arc furnace and integrated routes by several steel mills in North America and abroad. For simplicity, their addresses have not been included here.

EPD Number and Period of Validity
SCS-EPD-05042
EPD Valid July 11, 2018 through July 10, 2023

Product Category Rule
North American Product Category Rule for Designated Steel Construction Products

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Table of Contents

PRODUCT SCOPE ..... cover
ABOUT MIDVALLEY REBAR 2
PRODUCT DESCRIPTION 2
MATERIAL CONTENT 2
PRODUCT LIFE CYCLE FLOW DIAGRAM 3
LIFE CYCLE ASSESSMENT STAGES AND REPORTED INFORMATION 3
LIFE CYCLE IMPACT ASSESSMENT 4
SUPPORTING TECHNICAL INFORMATION 6
REFERENCES 8

PCR review, was conducted by	Tom Gloria, PhD, Industrial Ecology Consultants (Review Chair) Email: t.gloria@industrial-ecology.com
Approved Date: July 11, 2018 – End Date: July 10, 2023	
Independent verification of the declaration and data, according to ISO 14025:2006 and ISO 21930: 2007.	☐ internal ☑ external
Third party verifier	Jeremie Hakian, EPD Manager, SCS Global Services

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ABOUT MIDVALLEY REBAR

Midvalley Rebar is a member of the Salit Steel Group of companies, a family-owned and operated company founded in 1905. Our steel supports a number of industries including commercial and residential construction, industrial, infrastructure and industrial to name a few. Our clients include general contractors, concrete precasters, developers, manufacturers and more.

PRODUCT DESCRIPTION

This EPD is determined by fabricated reinforcing bar produced by three of Salit Steel's facilities in Saskatchewan, Ontario, and British Columbia intended to represent production at all facilities. Fabricated reinforcing bar is a steel bar used in the reinforcement of concrete. The rebar surface is rolled with a deformed pattern in order to form an improved mechanical bond with the concrete. Mechanical properties, sizes, and deformation dimensions are specified by Canadian Standards Association (CSA) and Reinforcing Steel Institute of Canada (RSIC). Fabricated rebar is cut and bent as necessary to form shapes to the needs of a particular project. Rebar sizes range from 10m to 55m at bar grades of 400 and 500. In accordance with the PCR, the declared unit and product density is shown in Table 1.

Table 1. *Declared unit for fabricated reinforcing bar and the approximate density.*

Parameter		Value	
Declared unit		1 metric ton	
Metric bar size	Linear mass density (kg/m)	Nominal diameter (mm)	Cross-sectional area (mm²)
10M	0.785	11.3	100
15M	1.570	16.0	200
20M	2.355	19.5	300
25M	3.925	25.2	500
30M	5.495	29.9	700
35M	7.850	35.7	1000
45M	11.775	43.7	1500
55M	19.625	56.4	2500

MATERIAL CONTENT

Including alloying elements, the fabricated product is composed of 99% steel with 1% of various alloys. Reinforcing bar products under normal conditions do not present inhalation, ingestion, or contact health hazards. These products, when used inside the building envelope, do not include materials or substances that have a potential route of exposure to humans or flora/fauna in the environment.

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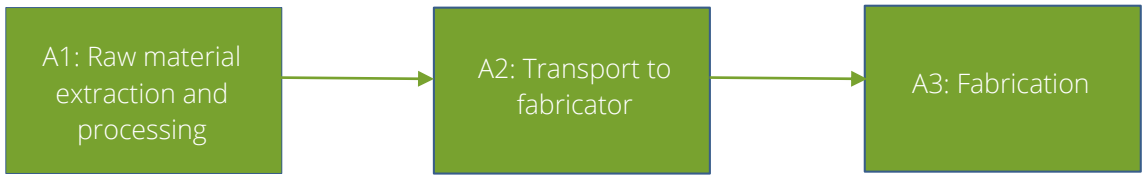
PRODUCT LIFE CYCLE FLOW DIAGRAM

The diagram below is a representation of the most significant contributions to the production of steel product. This includes resource extraction, steelmaking, transport to fabrication shops, and product fabrication. The cradle-to-gate (A1-A3) system boundaries are shown in the diagram.



LIFE CYCLE ASSESSMENT STAGES AND REPORTED INFORMATION

In accordance with the PCR, the life cycle stages included in this EPD are as shown below (X = included, MND = module not declared).

Product			Construction Process		Use							End-of-Life				Benefits & Loads Beyond the System Boundary
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Raw Material Extraction and	Transport to the Fabricator	Fabrication	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 = included, MND = module not declared

The following life cycle stages are included in the EPD:

Raw Material Extraction and Processing (A1): Includes all activities necessary for the production of reinforcing bar. This includes recovery and processing of steel scrap, and extraction and processing of alloys, fluxes, EAF (electric arc furnace) and integrated consumables, and refractory consumables. The transportation from the supplier of materials to the steel mill is included. Lastly, this stage includes furnace and related process operations, creation of the billet, and the rolling of the final product. All upstream activities related to fuel use and electricity generation are included in this stage.

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Transport to the Fabricator (A2): Includes the transportation of reinforcing bar from mill to fabricator by truck, rail, and ship.

Fabrication (A3): Includes all activities necessary for the fabrication of reinforcing bar, which includes production of all ancillary materials, pre-products, products, and packaging.
The Reference Service Life (RSL) of the products is not specified.

The construction process stage, use stage, end-of-life stage, and Module D of the product are excluded from the system boundaries of the study. Additional elements that are excluded from the study are:

- Construction activities, capital equipment and infrastructure
- Maintenance and operation of equipment
- Personnel travel and resource use

The deletion of these inputs or outputs is permitted since they are not expected to significantly change the overall conclusions of the study.

LIFE CYCLE IMPACT ASSESSMENT

Results are reported in Table 2 according to the LCIA methodologies of Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts (TRACI version 2.1) and CML-IA version 4.1.

Table 2: *LCIA results for 1 metric ton of fabricated reinforcing bar produced by Midvalley Rebar*

Impact Category	Impact Assessment Method	Units	Total (A1-A3)	A1	A2	A3
				Steel Production	Transport to the Fabricator	Fabrication
Global Warming Potential	TRACI 2.1	Metric ton CO_2 eq	1.34	1.23	$9.50x10^{-2}$	$8.68x10^{-3}$
Ozone Depletion Potential	TRACI 2.1	Metric ton CFC-11 eq	$-1.05x10^{-9}$	$-1.05x10^{-9}$	$5.10x10^{-15}$	$3.59x10^{-14}$
Acidification Potential	TRACI 2.1	Metric ton SO_2 eq	$6.04x10^{-3}$	$4.55x10^{-3}$	$1.46x10^{-3}$	$2.82x10^{-5}$
Eutrophication Potential	TRACI 2.1	Metric ton N eq	$4.36x10^{-4}$	$3.72x10^{-4}$	$6.09x10^{-5}$	$3.68x10^{-6}$
Photochemical Ozone Creation Potential	TRACI 2.1	Metric ton O_3 eq	$8.82x10^{-2}$	$5.72x10^{-2}$	$3.06x10^{-2}$	$3.58x10^{-4}$
Depletion of Abiotic Resources (Elements)[1]	CML-IA	Metric ton Sb eq	$-3.00x10^{-7}$	$-3.20x10^{-7}$	$1.64x10^{-8}$	$3.32x10^{-9}$
Depletion of Abiotic Resources (Fossil)	CML-IA	MJ, net calorific value	$1.55x10^{4}$	$1.41x10^{4}$	$1.29x10^{3}$	$1.21x10^{2}$

[1] This indicator is based on assumptions regarding current reserves estimates. Users should use caution when interpreting results because there is insufficient information on which indicator is best for assessing the depletion of abiotic resources.

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Resource Use:

The PCR requires that several parameters be reported in the EPD, including resource use, waste categories and output flows, and other environmental information. The results for these parameters per declared unit are shown in Table 3.

Table 3: *Resource use and wastes for 1 metric ton of fabricated reinforcing bar produced by Midvalley Rebar*

Parameter	Units	Total (A1-A3)	A1	A2	A3
			Steel Production	Transport to the Fabricator	Fabrication
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ, net calorific value	$9.84x10^{2}$	$9.84x10^{2}$	24.4	57.1
Use of renewable primary energy resources used as raw materials	MJ, net calorific value	0	0	0	0
Total use of renewable primary energy resources	MJ, net calorific value	$9.84x10^{2}$	$9.02x10^{2}$	24.4	57.1
Use of nonrenewable primary energy excluding nonrenewable primary energy resources used as raw materials	MJ, net calorific value	$1.67x10^{4}$	$1.53x10^{4}$	$1.30x10^{3}$	$1.68x10^{2}$
Use of nonrenewable primary energy resources used as raw materials	MJ, net calorific value	0	0	0	0
Total use of nonrenewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ, net calorific value	$1.67x10^{4}$	$1.53x10^{4}$	$1.30x10^{3}$	$1.68x10^{2}$
Use of secondary materials	Metric ton	0.836	0.836	0	0
Use of renewable secondary fuels	MJ, net calorific value	$8.29x10^{-10}$	$8.29x10^{-0}$	$5.32x10^{-28}$	$2.15x10^{-22}$
Use of nonrenewable secondary fuels	MJ, net calorific value	$1.24x10^{-8}$	$1.24x10^{-8}$	$8.76x10^{-27}$	$2.52x10^{-21}$
Net use of fresh water	m^3	3.17	2.99	0.111	$6.51x10^{-2}$
Hazardous waste disposed	Metric ton	$4.32x10^{-7}$	$4.25x10^{-7}$	$6.22x10^{-9}$	$9.76x10^{-11}$
Nonhazardous waste disposed	Metric ton	$6.19x10^{-2}$	$6.16x10^{-2}$	$4.42x10^{-5}$	$1.91x10^{-4}$
Radioactive waste disposed	Metric ton	$1.32x10^{-4}$	$1.09x10^{-4}$	$3.15x10^{-6}$	$1.91x10^{-5}$
Components for re-use	Metric ton	0	0	0	0
Materials for recycling	Metric ton	$3.43x10^{-2}$	0	0	$3.43x10^{-2}$
Materials for energy recovery	Metric ton	$3.47x10^{-5}$	$3.47x10^{-5}$	0	0
Exported energy	MJ per energy carrier	0	0	0	0

Disclaimer:

This Environmental Product Declaration (EPD) conforms to ISO 14025, 14040, ISO 14044, and ISO 21930.

Scope of Results Reported: *The PCR requires the reporting of a limited set of LCA metrics; therefore, there may be relevant environmental impacts beyond those disclosed by this EPD. The EPD does not indicate that any environmental or social performance benchmarks are met nor thresholds exceeded.*

Accuracy of Results: *This EPD has been developed in accordance with the PCR applicable for the identified product following the principles, requirements and guidelines of the ISO 14040, ISO 14044, ISO 14025 and ISO 21930 standards. The results in this EPD are estimations of potential impacts. The accuracy of results in different EPDs may vary as a result of value choices, background data assumptions and quality of data collected.*

Comparability: *EPDs are not comparative assertions and are either not comparable or have limited comparability when they cover different life cycle stages, are based on different product category rules or are missing relevant environmental impacts. Such comparisons can be inaccurate, and could lead to the erroneous selection of materials or products which are higher impact, at least in some impact categories. Any comparison of EPDs shall be subject to the requirements of ISO 21930. For comparison of EPDs which report different module scopes, such that one EPD includes Module D and the other does not, the comparison shall only be made on the basis of Modules A1, A2, and A3. Additionally, when Module D is included in the EPDs being compared, all EPDs must use the same methodology for calculation of Module D values.*

SUPPORTING TECHNICAL INFORMATION

Data Sources

Data for rebar production were obtained from a combination of published EPDs, the GaBi database, and, in one case, directly from a steel mill. All primary data for the transportation of reinforcing bar facilities in module A2 and fabrication processes in module A3 were collected from facilities for the fiscal year 2017. See Table 4 for a description of data sources used for the LCA.

Table 4: *Data sources used for the LCA study*

Module	Scope	Technology Source	Data Source	Region	Year
A1	Yes	GaBi ts	Published EPDs, LCI from a rebar producer from previous work, and the GaBi 2018 database	North America	2014-2017
A2	Yes	GaBi ts	Midvalley Rebar	North America	2017
A3	Yes	GaBi ts	Midvalley Rebar	Canada	2017
D	No	N/A	N/A	N/A	N/A

Allocation

Midvalley Rebar owns single output facilities; thus no multi-output allocation was needed for this project. All environmental burdens associated with the fabrication process were assigned to the fabricated rebar product.

Allocation of background data taken from the GaBi 2018 databases is documented online at http://www.gabi-software.com/international/databases/gabi-databases/.

Allocation in the rebar datasets was based on the SCS North American Product Category Rule for Designated Steel Construction Products. Allocation of co-products at the steel mill followed the guidance available in the PCR to use system expansion. Mill-specific details on the allocation of the co-products in the rebar datasets can be found in the available EPDs. Details regarding system expansion to incorporate the main co-products of BF-BOF route can be found in Section 4.6 and 3.6 of the 2011 and 2017 worldsteel LCI methodology reports, respectively (worldsteel Association, 2017; worldsteel Association, 2011).

Cut-off Criteria

Cut-off criteria are defined for this study by the PCR. Based on the PCR, in situations where there is a data gap or insufficient data, criteria for the exclusion of inputs and outputs shall be 1% of primary energy usage (including both 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 shall be 5% of primary energy usage and mass across all modules included in the LCA. The system boundary was defined based on relevance to the goal of the study. For the processes within the system boundary, all available energy and material flow data have been included in the model. In cases where no matching life cycle inventories are available to represent a flow, proxy data have been applied based on conservative assumptions regarding environmental impacts.

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Limitations

- The LCIA indicators prescribed by the PCR do not represent all categories of potential environmental impacts, such as terrestrial ecosystem impacts.
- The analysis relies on a combination of published EPDs, primary data from an upstream supplier, and secondary data from the GaBi 2018 database to model potential impacts of upstream rebar production.

Data Quality

Data Quality Parameter	Data Quality Discussion
Time-Related Coverage: Age of data and the minimum length of time over which data is collected	All primary fabrication data were collected for 12 consecutive months during the 2017 fiscal year. The majority of secondary data come from the GaBi 2018 databases and are representative of the years 2014-2017. Additionally, rebar mill data for some of Midvalley Rebar's suppliers were obtained from recently published EPDs.
Geographical Coverage: Geographical area from which data for unit processes is collected to satisfy the goal of the study	All primary and secondary data were collected specific to the location of manufacture when possible. Energy and transportation data used represent the country-specific infrastructure and emission factors. Raw material datasets were chosen for technological accuracy and are based on North American or international conditions as possible within the time and cost constraints of the study.
Technology Coverage: Specific technology or technology mix	The majority of primary data and all secondary data were modeled to be specific to the technologies or technology mixes under study. Datasets for upstream rebar represent production via both EAF and integrated routes.
Precision: Measure of the variability of the data values for each data expressed	As the majority of the relevant foreground data are measured data or calculated based on primary information sources of the owner of the technology, precision is considered to be high. Seasonal variations were balanced out by using yearly averages. All background data were obtained from the GaBi 2018 databased with the documented precision. Rebar production data were obtained from published EPDs or from the GaBi databases.
Completeness: Percentage of flow that is measured or estimated	Each unit process was checked for mass balance and completeness of the emissions inventory. 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, including rebar suppliers, 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 suppler chain back to resources extraction.
Consistency: Qualitative assessment of whether the study methodology is applied uniformly to the various components of the analysis	To ensure consistency, all primary data were collected with the required level of detail, while background data were sourced from the GaBi 2018 databases, suppliers EPDs, and primary data.
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	Reproducibility is supported through the disclosure of LCI data, dataset choices, and modelling approaches. Based on information provided in the background LCA report, any third party should be able to approximate the results of this study using the same data and approaches.
Sources of the Data: Description of all primary and secondary data sources	Primary data for rebar fabrication were provided by the Salit Steel group of companies. Secondary data were obtained from GaBi 2018 databases, supplier EPDs, and in one case, directly from a supplier. Data were analyzed for completeness and plausibility, and, when possible, benchmarked against existing numbers.
Uncertainty of the Information: Uncertainty related to data, models, and assumptions	The Salit Steel group of companies provided complete facility data. Their operation represent a small fraction of the potential impacts from A1-A3, so the effect on results is expected to be minimal.

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