Ternium

LATIN AMERICA EPD®

Environmental Product Declaration

In accordance with ISO 14025:2006 and EN 15804:2012

Steel reinforcing bar manufactured from steel scrap

Programme:	The International EPD® System www.environdec.com
EPD registered through the fully aligned regional programme/hub:	EPD Latin America, www.epd-latinamerica.com
Programme operator: Regional Hub:	EPD International AB EPD Latin America
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	An EPD should provide current information, and may be updated if conditions change. The stated validity is therefore subject to the continued registration and publication at www.environdec.com.
Revision date:	2018-05-17
Geographical scope:	Mexico

EPD Content

Ternium is a leading company in Latin America that manufactures and processes a broad range of steel products using the most advanced technology. The company provides customers that operate in such diverse and essential steel consuming industries, such as construction, automotive and energy, as well as manufacturers of heavy and agricultural machinery, household appliances and packaging, among others.

Ternium and its subsidiaries have 17 production centers in Argentina, Brazil, Colombia, Guatemala, Mexico, and the United States. It is also part of the controlling group of Usiminas, a leading steelmaker of the Brazilian market

Ternium supplies with high quality steel all the main regional markets and it also promotes the development of its customers from the metallurgical industry.

The company's distinctive position is a result of its highly integrated production procedure.

Its facilities feature the whole manufacturing process of steelmaking, from the mining of iron ore to the production of high value added products.

With a yearly achievable production capacity of 12.3 million tons, Ternium's shares are listed and traded on the New York Stock Exchange

"Our mission is to create value with our customers, improving competitiveness and productivity together, through a highly efficient industrial and technological base and a global commercial network. Ternium is committed to establishing a long term presence, through local development and education. "

-Daniel Novegil, Ternium's CEO 2017.

1. General information

Product	Steel rebar manufactured from steel scrap
Name of the manufacturer	Ternium México S.A. de C.V.
Description of the construction product	Steel rebars used to reinforce concrete in the construction industry. The surface of the rebar is corrugated to limit the relative longitudinal movement between the steel and the surrounding concrete.
Declared unit	1 metric ton of steel rebar manufactured from steel scrap, which is used as reinforcing steel for the construction industry.
Construction product identification	Central Product Classification: CPC 4124 Bars and rods, hot rolled, of iron or steel.
Description of the main product components and or materials	100% low-alloyed steel manufactured using 100% steel scrap as source of iron.
Programme:	International EPD® System,www.environdec.com EPD® EPD registered through the fully aligned regional programme/hub: EPD Latin America, www.epdlatinamerica.com LATIN AMERICA EPD®
Programme operator	EPD International AB Box 210 60 SE-100 31 Stockholm, Sweden EPD Latin America Chile: Alonso de Arcilla 2996, Ñuñoa, Santiago Chile Mexico: Boulevard de los Continentes No. 66 Colonia Valle Dorado. C.P. 54040 Tlalnepantla de Baz, Estado de México. México
Date of issue:	2018-05-25
Valid to:	2023-05-16
Life cycle stages not considered	Distribution, use, end of life.
Comparability of EPD of construction products	a. EPD of construction products may not be comparable if they do not comply with EN 15804. b. Environmental product declarations within the same product category from different programs may not be comparable
For more information consult	mx.ternium.com
Environmental policy and management system	ISO 14001 ISO 9001
Sites for which this EPD is representative	Ternium Largos Norte Works Camino al Mezquital 200, San Nicolás de los Garza (66440) Nuevo León. (+52) 81 88652828

2. The product

Steel rebar used to reinforce concrete in the construction industry. The surface of the rebar is corrugated to limit the relative longitudinal movement between the steel and the surrounding concrete.

Steel reinforcing bar produced by Ternium Largos Norte Works in San Nicolas de los Garza, Nuevo León is produced using 100% steel scrap as source of iron.

The product is manufactured according to Mexican standard NMX-B506-CANACERO-2011 and U.S. standard ASTM A615/A615M-16.

The characteristics of steel reinforcing bars produced by Ternium Mexico are provided in the following Tables:

Physical dimensions

	Nominal dimensions				Specification of shape		
Designation number[a]	Caliber (inch.)	Diameter[b] (mm)	Perimeter (mm)	Cross-sectional area (mm²)	Maximum average distance (mm)	Minimum average height (mm)	Maximum transversal distance (mm)
2.5	5/16	7.9	49	24.8	5.6	0.3	3.0
3	3/8	9.5	71	29.8	6.7	0.4	3.6
4	1/2	12.7	127	39.9	8.9	0.5	4.9
5	5/8	15.9	198	50.0	11.1	0.7	6.1
6	3/4	19.0	285	60.0	13.3	1.0	7.3
8	1	25.4	507	79.8	17.8	1.3	9.7
10	1 1/4	31.8	749	99.9	22.3	1.6	12.2
12	1 1/2	38.1	1 140	119.7	26.7	1.9	14.6

a The designation number corresponds to the number of eighths of an inch.

b The nominal diameter of a corrugated bar is equivalent to the diameter of a non-corrugated bar with the same nominal mass as the corrugated bar.

Bending test

Minimum bending diameter	Grade 42	Grade 52
Bar	Equation for minimum mandrel diameter	
2.5	3.5 x d	4.0 x d
3, 4 and 5	3.5 x d	5.0 x d
6 and 8	5.0 x d	5.0 x d
10	7.0 x d	7.0 x d
12	8.0 x d	8.0 x d

d = Nominal diameter (mm) of the bar.

Weight and nominal mass

Designation number	Caliber (inch.)	Nominal mass (kg per piece of 9.15 m)	Nominal weight (kg per piece of 12 m)	Nominal weight (kg/m)	Number of pieces per metric ton of product
2.5	0.31	---	4.60	0.38	217 ± 7
3	0.38	5.10	6.70	0.56	149 ± 4
4	0.50	9.20	12.0	0.99	84 ± 2
5	0.63	14.3	18.7	1.55	54 ± 1
6	0.75	20.6	27.0	2.24	37 ± 1
8	1.00	36.4	47.7	3.97	21
10	1.25	57.0	74.7	6.23	13
12	1.50	81.8	107	8.94	9

Mass tolerance: +/- 6.0% per piece and +/-3.5% bulk regarding nominal weight (NMX-B506-CANACERO-2011 and ASTM A615/A615M-16).

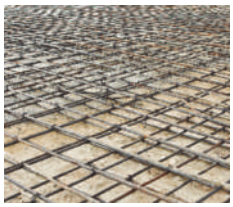
Note: This information is based on a 12 m-long bar.

Tensile strength

	Grade 42	Grade 52
Minimum tensile strength in N/mm2 (kgf/mm2)	617 (63)	706 (72)
Minimum yield stress in N/mm2 (kgf/mm2)	412 (42)	510 (52)
Designation number	Minimum elongation in 200 mm	Minimum elongation in 200 mm
2.5	9%	8%
3, 4, 5 and 6	9%	7%
8	8%	7%
10 and 12	7%	6%

Steel reinforcement bar is manufactured by Ternium Mexico according to specifications NMX-B506-CANACERO-2011 and ASTM A615/A615M-16.

Applications



3. Content declaration

A list of materials and chemical substances including information about their hazardous properties is provided next:

Steel rebar manufactured in the Largos Apodaca (also called Largos Norte) Industrial Center of Ternium Mexico uses 100% steel scrap as source of iron.

Material content in the product			
Material	Function	Weight (%)	Health class[1]
Low-alloyed steel	Reinforce concrete structures	100%	Non hazardous

[1]*According to EN15804 declaration of material content of the product shall list Substance of Very High Concern (SVHC) that are listed by European Chemicals Agency.*

4. Declared unit

1 metric ton of steel rebar manufactured from steel scrap, which is used as reinforcing steel for the construction industry.

5. Flow diagram and general system boundaries

Environmental potential impacts were calculated according to EN 15804:2012 and PCR 2012:01 Construction products and construction services Version 2.2 (2017-05-30). This EPD is in accordance with ISO 14025:2006.

The approach of this EPD is from the cradle to gate, as system boundary.

Environmental potential impacts were calculated through Life Cycle Assessment (LCA) methodology according to ISO 14040:2006 and ISO 14044:2006. An external third party critical review process of the LCA was conducted according to ISO/TS 14071:2014.

The following Table describes the scope of the inventory performed in the LCA.

Life cycle environmental information of steel reinforcing bar manufactured from from steel scrap							Other environmental information
Product stage			Construction process stage		Use stage	End of life stage	Reuse recovery stage
A1	A2	A3	A4	A5	B1 - B7	C1 - C4	D
Production of ferroalloys, lime, carbon, graphite electrodes, calcium carbide and packaging materials for raw materials. Electricity generation and natural gas production used during manufacturing. Steel scarp supply.	Transportation of scrap steel. Transportation of other raw materials. Transportation of ancillary materials. Internal transport.	Fresh water consumption. Production and consumption of ancillary materials: chemicals for water treatment, textiles for cleaning and maintenance, lubricating oils and grease. Waste transportation, waste treatment and, emissions to air and water.	Product distribution	Construction and installation	Use, maintenance, repair, replacement, refurbishment, operational energy use, operational water use	De-construction, demolition, transport, waste processing, disposal	Re-use-Recovery-Recycling-potential
Included	Included	Included	MND	MND	MND	MND	MND
Cradle-to-gate Declared unit							

MND = Module not declared

Ternium Mexico collected primary (specific) data from annual internal records of the year 2016 for the following aspects:

- Distance for transportation of raw materials and ancillary materials for steel reinforcing bar manufacturing.
- Raw materials consumption for manufacturing.
- Energy consumption for manufacturing
- Production yield and generation of by products
- Consumption of ancillary materials during manufacturing
- Waste generation and management strategies
- Emissions to air during manufacturing process
- Distance for transportation of waste to treatment

Secondary (generic) data for upstream processes were used for the following elements:

- Consumption of fuels and emissions related to electricity production by independent providers.
- Energy and materials consumption and emissions related to the production of raw materials for steelmaking.
- Materials and energy consumption, emissions related to transport of raw materials and ancillary materials.
- Energy and materials consumption and emissions related to the production of ancillary inputs.
- Materials and energy consumption, emissions and waste management related to transport of waste.

5.1 Description of information modules

Description of information modules included in this EPD is provided below:

A1) Raw materials supply

Production of other raw materials: ferroalloys, lime, carbon, graphite electrodes, calcium carbide.

Production of packaging materials for raw materials.

Generation and distribution of the electricity consumed in manufacturing.

Production and processing of natural gas used as fuel during the manufacturing process.

Steel scrap supply

A2) Transportation

Transportation of steel scrap.

Transportation of other raw materials.

Transportation of ancillary materials.

Internal transport.

A3) Manufacturing

Consumption of fresh water.

Production and consumption of ancillary materials: chemicals for water treatment, tow and rag for cleaning and maintenance, lubricating oils and grease.

Waste generation and waste management processes.

Emissions to air and water.

Transport of waste to the treatment and final disposal site.

Steel reinforcing bar is manufactured in the industrial center Largos Apodaca, located in San Nicolás de los Garza, Nuevo León. The production process flow is depicted below:

5.2 Data quality assessment

The assessment of data quality is provided in this EPD

Module A1) Raw materials supply					
Data	**Time related coverage**	**Geographical coverage**	**Technological coverage**	**Data source**	**Measured or estimated**
Energy consumption for scrap preprocessing.	2018	Europe	Modern	Machinery suppliers of scrap processing	E
Raw materials consumption for steel reinforcing bar manufacturing.	2016	Mexico	Modern	Ternium Mexico	M
Energy consumption for steel reinforcing bar manufacturing.	2016	Mexico	Modern	Ternium Mexico	M
Consumption of fuels and emissions related to electricity production in Mexico at country level	2016	Mexico	Modern Mexican energy mix	Mexicaniuh	M&E
Consumption of fuels and emissions related to electricity production by independent providers	2000 - 2016	Mexico	Modern Natural gas Combined cycle	Ecoinvent 3.3 adapted	M&E
Energy and materials consumption and emissions related to natural gas production in Mexico	2016	Mexico	Modern	Mexicaniuh	M&E
Energy and materials consumption and emissions related to the production of other raw materials for steelmaking	1990-2016	Europe	Modern	Ecoinvent 3.3	M&E

Module A2) Transportation					
Data	**Time related coverage**	**Geographical coverage**	**Technological coverage**	**Data source**	**Measured or estimated**
Distance for transportation of raw materials	2016	Mexico	Not applicable	Ternium Mexico	M
Distance for transportation of ancillary inputs	2016	Mexico	Not applicable	Ternium Mexico	M
Materials and energy consumption, emissions and waste management related to transport of raw materials and ancillary materials.	1992-2014	World average based on Europe	World average based on Europe	Ecoinvent 3.3	M&E

Module A3) Manufacturing					
Data	Time related coverage	Geographical coverage	Technological coverage	Data source	Measured or estimated
Production yield and generation of by products	2016	Mexico	Modern	Ternium Mexico	M
Consumption of ancillary materials during manufacturing	2016	Mexico	Modern	Ternium Mexico	M
Energy and materials consumption and emissions related to the production of ancillary inputs	1990 - 2016	World average based on Europe	World average based on Europe	Ecoinvent 3.3	M&E
Waste generation during manufacturing process and management strategies	2016	Mexico	Modern	Ternium Mexico	M
Energy and materials consumption and emissions related to waste treatment process	1990 - 2016	World average based on Europe	World average based on Europe	Ecoinvent 3.3	M&E
Emissions to air during manufacturing process	2016	Mexico	Modern	Ternium Mexico EPA AP42	M
Distance for transportation of waste to treatment	2016	Mexico	Modern	Ternium Mexico y Google Maps	M
Materials and energy consumption, emissions and waste management related to transport of waste.	1992-2014	World average based on Europe	World average based on Europe	Ecoinvent 3.3	M&E

6. Environmental performance-related information

Since this is a Cradle to Gate EPD, reference service life is not specified.

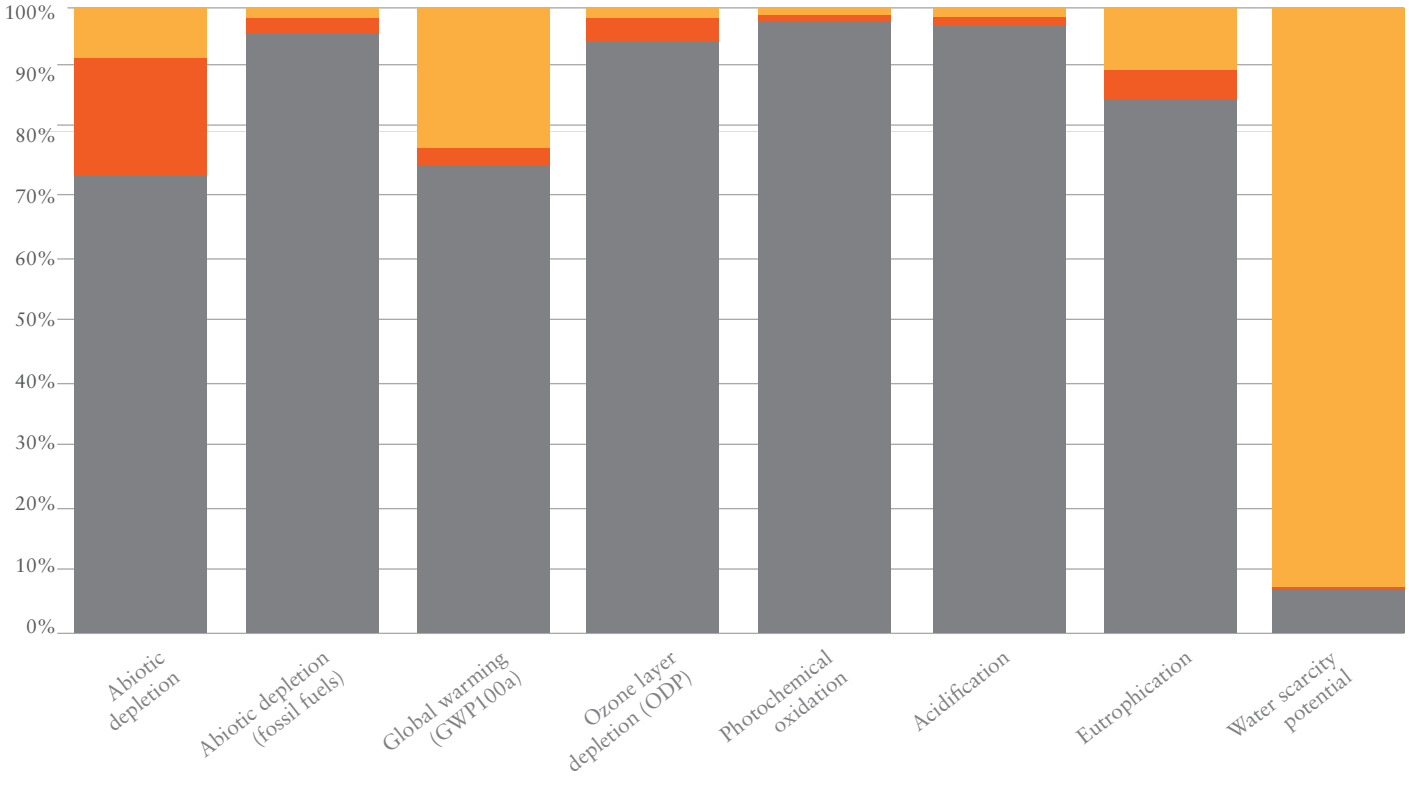
6.1 Potential environmental impact

All individual information modules are reported separately. However, as supplement information a figure for the total impact across all phases is provided.

Parameters describing environmental potential impacts were calculated using CML-IA method version 3.04 (Guinee et al. 2001; Huijbregts et al. 2003; Wegener et al. 2008) as implemented in SimaPro 8.4. Water scarcity potential was calculated using AWARE method (Boulay et al. 2018).

Potential environmental impact · Steel rebar manufactured from steel scrap						
Impact Category	Unit	A1) Raw materials	A2) Transportation	A3) Manufacture	Total A1 - A3	A4 - A5, B1-B7, C1-C4, D
Abiotic depletion	kg Sb equiv	7.76E-05	2.23E-05	8.16E-06	1.08E-04	
	%	71.8%	20.6%	7.5%	100%	
Abiotic depletion (fossil fuels)	MJ	8 174	177	115	8 466	
	%	96.5%	2.1%	1.4%	100%	
Global warming (GWP100a)	kg CO_2 equiv	338	12	101	451	
	%	75.0%	2.6%	22.4%	100%	
Ozone layer depletion (ODP)	kg CFC-11 equiv	5.33E-05	1.95E-06	8.28E-07	5.61E-05	
	%	95.0%	3.5%	1.5%	100%	Modules not declared
Photochemical oxidation	kg C_2H_4 eq	4.93E-01	2.97E-03	3.50E-03	5.00E-01	
	%	98.7%	0.6%	0.7%	100%	
Acidification	kg SO_2 equiv	4.26E+00	6.62E-02	7.12E-02	4.40E+00	
	%	96.9%	1.5%	1.6%	100%	
Eutrophication	kg PO4--- eq	2.14E-01	1.52E-02	2.37E-02	2.53E-01	
	%	84.7%	6.0%	9.4%	100%	
Water scarcity potential	m^3eq	9	1	134	144	
	%	6.6%	0.4%	93.0%	100.0%	

Note: AWARE method sets the maximal characterization factor (i.e. 100) for the geographical location of Ternium Largos Norte Works. However, AWARE factor is linked to Ecosystem Water Requirement (EWR) which is calculated at global scale and does not account for specific local aspects due to limited data access. EWR is the most uncertain variable of the method (Boulay et al. 2018).



A1) Raw materials supply

A2) Transportation

A3) Manufacturing

6.2 Use of resources

Environmental parameters describing the use of renewable and non-renewable material resources, renewable and non-renewable primary energy as well as the generation of materials for recycling or energy recovery are presented below: Parameters describing resource use were evaluated with the Cumulated Energy Demand method version 1.09 (Frischknecht et al. 2007) except for the indicator of use of net fresh water that was evaluated with ReCiPe 2016 (Huijbregts et al. 2017).

Parameter	Unit	Total A1 - A3	A1) Raw materials supply	A2) Transportation	A3) Manufacture (direct)**	A3) Manufacture (indirect)**
Use of renewable primary energy	MJ	412	400	3	0	9
excluding renewable primary energy resources used as raw materials	%	100%	97%	1%	0%	2%
Use of renewable primary energy as raw materials	MJ	0	0	0	0	0
	%	-	0%	0%	0%	0%
Total use of renewable primary energy resources	MJ	412	400	3	0	9
	%	100%	97%	1%	0%	2%
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	8 500	8 202	175	0	123
	%	100%	97%	2%	0%	1%
Use of non-renewable primary energy used as raw materials	MJ	0	0	0	0	0
	%	-	0%	0%	0%	0%
Total use of non-renewable primary energy resources	MJ	8 500	8 202	175	0	123
	%	100%	97%	2%	0%	1%
Use of secondary material	kg	980	0	0	980	0
	%	100%	0%	0%	100%	0%
Use of renewable secondary fuels	MJ	0	0	0	0	0
	%	-	0%	0%	0%	0%
Use of non-renewable secondary fuels	MJ	0	0	0	0	0
	%	-	0%	0%	0%	0%
Use of net fresh water	m^3	1.84	0.46	0.04	1.10	0.24
	%	100%	25%	2%	60%	13%

***The column "A3) Manufacturing (direct) refers to direct data from Ternium operations. The column "A3) Manufacturing (indirect) refers to background data regarding production of ancillary materials and other processes outside Ternium's facilities".*

6.3 Other indicators describing waste categories

Environmental indicators describing waste generation are provided in this EPD. Environmental indicators describing waste generation were obtained from LCI except for background information which has been calculated using EDIP 2003 method (Hauschild and Potting, 2005)

Parameter	Unit	Total	1) Raw materials supply	A2) Transportation	A3) Manufacturing (direct)**	A3) Manufacturing (Indirect)**
Hazardous waste	kg	20.5	0.0	0.0	20.5	0.0
	%	100%	0%	0%	100%	0%
Non hazardous waste	kg	44.7	24.5	7.5	6.2	6.6
	%	100%	55%	17%	14%	15%
Radioactive waste*	kg	9.18E-03	7.76E-03	1.04E-03	0	3.73E-04
	%	100%	85%	11%	0%	4%
Components for reuse	kg	0	0	0	0	0
	%	-	0%	0%	0%	0%
Materials for recycling	kg	175	0	0	175	0
	%	100%	0%	0%	100%	0%
Materials for energy recovery	kg	0.19	0	0	0.19	0
	%	100%	0%	0%	100%	0%
Exported electricity	MJ	0	0	0	0	0
	%	-	0%	0%	0%	0%
Exported heat	MJ	7.24	0	0	7.24	0
	%	100%	0%	0%	100%	0%

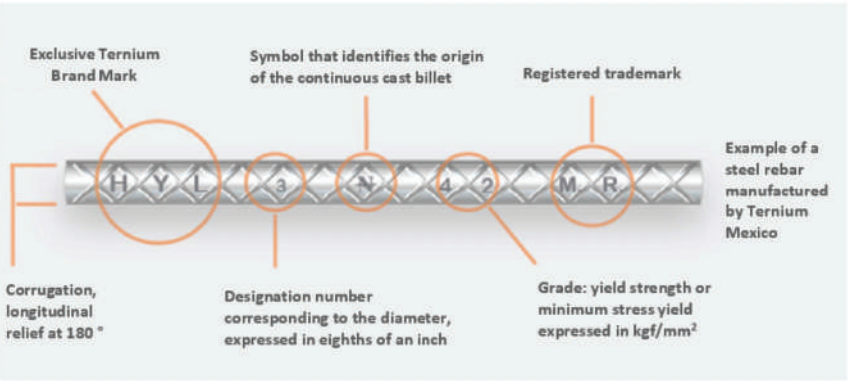
**No radioactive waste is produced during Ternium operations.*

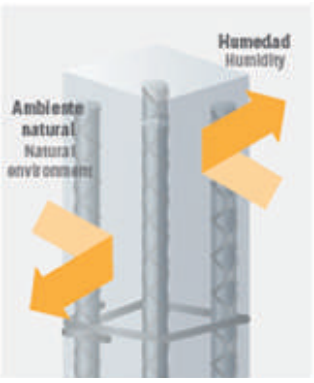
***The column "A3) Manufacturing (direct) refers to direct data from Ternium operations. The column "A3) Manufacturing (indirect) refers to background data regarding production of ancillary materials and other processes outside Ternium's facilities".*

6.4 Additional environmental information

Ternium Largos Norte, is certified with ISO 14001 and Industria Limpia Award. Also, an environmental policy is kept in practice in all industrial centers of the company in Mexico.

Product photographs certified with this EPD are shown below. And you can find additional information about certifications, award, and active participation of Ternium.





Rust contributes to microscopic porosity in steel, which increases its adherence to concrete and avoids structure slipping.

North American Regulation ACI 318 95, recommendation R7.4

Ternium Certifications

Environment
Largos Norte Works of Ternium in Mexico participates in the National Voluntary Environmental Audit Program, by PROFEPA (Federal Office for Environment Protection), keep continuously its certification as a clean industry. This way, it is ensured that the steel rebar manufacture process comply with the current regulations established to protect the environment.

Likewise, the Environment Management System of Largos Norte Works is certified under the ISO 14001 standard, in its latest version.

Quality
To ensure the quality of the reinforcing bar produced in Ternium's Largos Norte Works, the fabrication process is certified with ISO 9001 quality standard, in its latest version. Additionally, the chemical and physical test labs are certified with ISO 17025 standard, as well in its latest version.

Safety
To ensure the physical integrity and occupational health of all personnel, the Safety Management System of Largos Norte Works is certified with OHSAS 18000 standard.

Sustainability and environment protection
Ternium elaborates 100% recyclable products, of the highest quality and minimal impact on the environment. Recycling is part of the company, as well as ensure a long-term healthy link with the communities neighboring the productive centers.

Ternium is profoundly committed to sustainable development, which is why its actions are oriented to Environmental Policies that involve employees, stakeholders, suppliers, clients, and communities. The company has a Management System that foresees procedures, revisions, and specific registries for proper operations, maintenance, and control of installations.

Active Participation

Ternium reports, since 2005, the CO_2 emissions to the World Steel Association. This garnered the distinction of the program "Climate Action Member". Additionally, it subscribed to the sustainability index report and also reports energetic consumption and personnel training. Likewise, the company is part of different groups worried for the environment, main figure of the Entrepreneur World Board for Sustainable Development (National Chapters), the Latin American Steel Association (Alacero), World Steel Association, and diverse work commissions in various industrial associations. In Mexico, it participates through the related commissions with environmental topics and energy saving of the Nation Chamber of Iron and Steel (CANACERO), the Mining Chamber of Mexico (CAMIMEX), and the Institute for Environment Protection of Nuevo León (IPA NL).

Clean Industry

The productive facilities of Ternium in Mexico have revalidated the Clean Industry certificate. This distinction confirms that not only do the processes and practices of Ternium comply with the environmental regulations, but the facilities of the company are systematically audited with the goal of verifying their compliance with the current regulations.

For the production of Ternium steel rebar in Largos Norte Works, Ternium has the certificate of Environmental Management System.

6.5 Specific statements about this EPD

a) Geographical coverage: Mexico.

b) Scope of the EPD: This EPD only covers the Cradle to Gate life cycle stages because other stages are very dependent on particular scenarios and are better developed for specific building or construction works.

c) EPD Comparison:
a. EPD of construction products may not be comparable if they do not comply with EN 15804
b. Environmental product declarations within the same product category from different programs may not be comparable

d) Additional information can be provided on the request of the costumer.

e) Allocation rules:
a.Allocation for co-products: The first allocation procedure was performed so that it reflects the way in which the inputs and outputs change by cuantitative changes in the products (or functions) delivered by the system. In this case, a mass-basis allocation procedure was applied when co-products are present in a process.

Process	By-product
Steelmaking	Slag
Hot rolling	Steel scale

b. Allocation for recycling: Allocation of recycled material known as open loop recycling, is reported in the inventory under the Polluters Pay (PP) allocation method. In the PP allocation method, the exact boundary settings between the first and the next product systems are defined by the willingness to pay for the recycled material. This implies that for inflow of recycled material to the product system, the recycling process and the transportation from the recycling process to where the material is used were included. If an outflow of material to recycling was reported, the transportation of the material to a sorting facility or recycling process was included.

f) Cut off criteria applied in the EPD:
a. Environmental impact from construction, production equipment, and tools that are not directly consumed in the production process are not accounted for in the LCI.
b. Personnel-related impacts, such as transportation to and from work, are also not accounted for in the LCI.
g) Key assumptions of the LCA:
a. It was assumed that natural gas consumed in the manufacturing process is produced in the industrial gas processing center Burgos, located in Reynosa, Tamaulipas.
b. It was assumed that tow and rags leave the system in the form of impregnated textiles and that they have the capacity to absorb 55% of their weight.

7. Verification and registration

CEN standard EN 150804 served as the core PCR	
Programme:	International EPD® System, ww.environdec.com
Programme operator:	EPD International
EPD registered through the fully aligned regional programme/hub:	EPD Latin America, ww.epd-latinamerica.com
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Reference year of data:	2016
Geographical scope:	Mexico
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PCR:	PCR 2012:01 construction products and construction services, Version 2.2 (2017-05-03).
PCR review was conducted by:	The Technical Committee of the International EPD® System. Chair: Massimo Marino. Contact via info@environdec.com
Independent verification of the declaration data, according to ISO14025:2006:	EPD verification
External third party verifier and critical reviewer of the LCA:	Claudia A. Peña
Accredited or approved by:	The International EPD® System

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