Environmental Product Declaration

BREG EN EPD No.: 000138 Issue: 01

ECO EPD Ref. No.: 000432

This is to certify that this verified Environmental Product Declaration provided by:

Outokumpu Stainless Ltd (member of UK CARES)

Is in accordance with the requirements of:

EN 15804:2012+A1:2013

This declaration is for:

Stainless Steel Reinforcing Bar (secondary production route – scrap)

Company Address

Europa Link

Sheffield
S9 1TZ

outokumpu
high performance stainless steel

Signed for BRE Global Ltd	Emma Baker Operator	22 September 2016 Date of this Issue
22 September 2016 Date of First Issue		31 July 2019 Expiry Date

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EPD verification and LCA details

Demonstration of Verification
CEN standard EN 15804 serves as the core PCR[a]
Independent verification of the declaration and data according to EN ISO 14025:2010 ☐ Internal ☑ External
Third party verifier[b]: **Kim Allbury**
a: Product category rules b: Optional for business-to-business communication; mandatory for business-to-consumer communication (see EN ISO 14025:2010, 9.4)

LCA Consultant	Verifier
UK CARES EPD Tool thinkstep UK Ltd Euston Tower - Level 33, 286 Euston Road London NW1 3DP www.thinkstep.com	Kim Allbury BRE Global Bucknalls Lane Watford WD25 9XX www.bre.co.uk

Commissioner of LCA study	
UK CARES Pembroke House 21 Pembroke Road Sevenoaks, Kent TN13 1XR	

General Information

Summary

This environmental product declaration is for 1 tonne of Stainless Steel Reinforcing Bar (secondary production route – scrap) produced by Outokumpu Stainless Ltd (member of UK CARES) at the following manufacturing facilities:

Outokumpu Stainless Ltd (member of UK
CARES)
Europa Link

Sheffield
S9 1TZ
UK

This is a Cradle to gate with options EPD. The life cycle stages included are as shown below (X = included, MND = module not declared):

Product			Construction		Use stage							End-of-life					Benefits and loads beyond the system boundary
					Related to the building fabric					Related to the building							
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4		D
Raw materials supply	Transport	Manufacturing	Transport to site	Construction - Installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational Energy Use	Operational Water use	Deconstruction	Transport	Waste processing	Disposal		Reuse, Recovery and/or Recycling potential
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X

Programme Operator

BRE Global, Watford, Herts, WD25 9XX, United Kingdom.
This declaration is based on the BRE Environmental Profiles 2013 Product Category Rules for Type III environmental product declaration of construction products to EN 15804:2012+A1:2013.

Comparability

Environmental declarations from different programmes may not be comparable if not compliant with EN 15804:2012+A1:2013. Comparability is further dependent on the product category rules used and the source of the data, e.g. the database. See EN 15804:2012+A1:2013 for further guidance.

Construction Product

Product Description

Stainless Steel Reinforcing Bar according to BS 6744 and ASTM A955 that is obtained from scrap, melted in an Electric Arc Furnace (EAF) followed by hot rolling.

The declared unit is 1 tonne of stainless steel reinforcing bars as used within concrete structures for a commercial building.

Technical Information

Property	Value	Unit
Production route	EAF	-
Density, Modulus of Elasticity and Shear Modulus (* varies with alloy content)	*	-
Weldability	max 0.04	Ceq
Yield strength	500	N/mm²
Tensile strength	650 - 680	N/mm²
Surface geometry	0.039 - 0.056	fR
Elongation (Agt)	max 30	%
Bend and re-bend test (** Tests carried out by Outokumpu Stainless Ltd as per BS 8666)	Pass **	-
Fatigue test (*** Test carried out by Outokumpu Stainless Ltd as per BS 6744)	Pass ***	-
Recycled content	58.48	%

Product Contents

Material/Chemical Input	%
Fe	69
C (max)	0.04
Mn	4 - 6
Si (max)	1
Ni	1.35 - 1.70
Cu	0.10 - 0.80
Cr	21 - 22
Mo	0.10 - 0.80

Manufacturing Process

Scrap metal is melted in an electric arc furnace to obtain liquid steel. This is then refined to remove impurities and alloying additions can be added to give the required properties.

Hot metal (molten steel) from the EAF is then cast into steel billets before being sent to the rolling mill where they are rolled and shaped to the required dimensions for the finished bars and coils of stainless steel reinforcing steel.

The process flow diagram is shown below:

Construction Installation

Processing and proper use of stainless steel reinforcing products depends on the application and should be made in accordance with generally accepted practices, standards and manufacturing recommendations.

During transport and storage of stainless steel reinforcing products the usual requirements for securing loads is to be observed.

Use Information

The composition of the stainless steel reinforcing products does not change during use.

Stainless steel reinforcing products do not cause adverse health effects under normal conditions of use.

No risks to the environment and living organisms are known to result from the mechanical destruction of the stainless steel reinforcing bar product itself.

Reference Service Life

Stainless steel reinforcing products are used in the main building structure so the reference service life will equal the lifetime of the building.

End of Life

Stainless steel reinforcing products are not reused at end of life but can be recycled to the same (or higher/lower) quality of steel depending upon the metallurgy and processing of the recycling route.

It is a high value resource so efforts are made to recycle stainless steel scrap rather than disposing of it at EoL.

A recycling rate of 92% is typical for stainless steel reinforcing products. Disposal results in minimal environmental impacts due to the inert nature of the material.

Life Cycle Assessment Calculation Rules

Declared / Functional unit

The declared unit is 1 tonne of stainless steel reinforcing bars manufactured by the secondary (scrap-based) production route as used within concrete structures for a commercial building (i.e. 1 tonne in use, accounting for losses during fabrication and installation, not 1 tonne as produced).

System boundary

The system boundary of the EPD follows the modular design defined by EN 15804. This is a cradle to gate – with all options EPD and thus covers all modules from A1 to C4 and includes module D as well.

Impacts and aspects related to losses/wastage (i.e. production, transport and waste processing and end-of-life stage of lost waste products and materials) are considered in the modules in which the losses/wastage occur.

Data sources, quality and allocation

Data Sources: Production data has been supplied by Outokumpu Stainless Ltd (member of UK CARES).

Data Quality: Data quality can be described as good. Background data are consistently sourced from thinkstep databases. The primary data collection was thorough, considering all relevant flows and these data have been verified by UK CARES.

Allocation: EAF slag and mill scale are produced as a co-products from the steel manufacturing process; with mill scale also a by-product at the rolling mill. Impacts are allocated between the steel, the slag and the mill scale based on economic allocations.

Production losses of steel during the production process are recycled in a closed loop offsetting the requirement for external scrap.

Specific information on allocation within the background data is given in the GaBi datasets documentation (/GaBi 6 2014/).

Cut-off criteria

On the input side all flows entering the system and comprising more than 1% in total mass or contributing more than 1% to primary energy consumption are considered. All inputs used as well as all process-specific waste and process emissions were assessed. For this reason material streams which were below 1% (by mass) were captured as well. In this manner the cut-off criteria according to the BRE guidelines are fulfilled.

LCA Results

(INA = Indicator not assessed, AGG = Aggregated, NA = Not Applicable)

Indicator	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3
		Raw Material supply	Transport to factory	Manufacturing	Merged A1/A2/A3	Transport to site	Construction - installation	Use	Maintenance	Repair
Environmental impacts per declared/functional unit										
GWP	kg CO_2 eq.	AGG	AGG	AGG	3680	16.1	369	0.00	0.00	0.00
ODP	kg CFC 11 eq.	AGG	AGG	AGG	2.54E-07	7.39E-11	-3.56E-08	0.00	0.00	0.00
AP	kg SO_2 eq.	AGG	AGG	AGG	18.4	0.0396	1.76	0.00	0.00	0.00
EP	kg $(PO_4)^{3-}$ eq.	AGG	AGG	AGG	1.18	0.00918	0.116	0.00	0.00	0.00
POCP	kg C_2H_4 eq.	AGG	AGG	AGG	1.31	-0.0111	0.121	0.00	0.00	0.00
ADPE	kg Sb eq.	AGG	AGG	AGG	0.054	1.07E-06	0.00504	0.00	0.00	0.00
ADPF	MJ eq.	AGG	AGG	AGG	40900	221	4120	0.00	0.00	0.00
GWP = Global Warming Potential (Climate Change); ODP = Ozone Depletion Potential; AP = Acidification Potential for Soil and Water; EP = Eutrophication Potential; POCP = Photochemical Ozone Creation; ADPE = Abiotic Depletion Potential – Elements; ADPF = Abiotic Depletion Potential – Fossil Fuels										
Resource use										
PERE	MJ	AGG	AGG	AGG	5800	12.6	621	0.00	0.00	0.00
PERM	MJ	AGG	AGG	AGG	0.00	0.00	0.00	0.00	0.00	0.00
PERT	MJ	AGG	AGG	AGG	5800	12.6	621	0.00	0.00	0.00
PENRE	MJ	AGG	AGG	AGG	49000	222	4960	0.00	0.00	0.00
PENRM	MJ	AGG	AGG	AGG	0.00	0.00	0.00	0.00	0.00	0.00
PENRT	MJ	AGG	AGG	AGG	49000	222	4960	0.00	0.00	0.00
SM	kg	AGG	AGG	AGG	653	0.00	64.6	0.00	0.00	0.00
RSF	MJ	AGG	AGG	AGG	0.313	0.00	0.0311	0.00	0.00	0.00
NRSF	MJ	AGG	AGG	AGG	3.30	0.00	0.328	0.00	0.00	0.00
FW	m^3	AGG	AGG	AGG	23000	31.5	2310	0.00	0.00	0.00
PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used as raw materials; PENRT = Total use of non-renewable primary energy resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Net use of fresh water										
Waste to disposal										
HWD	kg	AGG	AGG	AGG	1.25	1.68E-05	0.125	0.00	0.00	0.00
NHWD	kg	AGG	AGG	AGG	382	0.0187	47.9	0.00	0.00	0.00
TRWD	kg	AGG	AGG	AGG	3.32	0.000318	0.343	0.00	0.00	0.00
RWDHL	kg	AGG	AGG	AGG	0.00405	4.65E-07	0.000417	0.00	0.00	0.00
HWD = Hazardous waste disposed; NHWD = Non-hazardous waste disposed; TRWD = Total Radioactive waste disposed; RWDHL = Radioactive waste disposed (high-level nuclear waste)										
Other output flows										
CRU	kg	AGG	AGG	AGG	0.00	0.00	0.00	0.00	0.00	0.00
MFR	kg	AGG	AGG	AGG	0.00	0.00	20.4	0.00	0.00	0.00
MER	kg	AGG	AGG	AGG	0.00	0.00	0.00	0.00	0.00	0.00
EE	MJ	AGG	AGG	AGG	0.00	0.00	0.00	0.00	0.00	0.00
CRU = Components for reuse; MFR = Materials for recycling; MER = Materials for energy recovery; EE = Export energy										

LCA Results (continued)

(INA = Indicator not assessed, AGG = Aggregated, NA = Not Applicable)

Indicator	Unit	B4	B5	B6	B7	C1	C2	C3	C4	D
		Replacement	Refurbishment	Operational energy use	Operational water use	Demolition	Transport	Waste Processing	Disposal	Reuse/ Recovery/ Recycling Potential
Environmental impacts per declared/functional unit										
GWP	kg CO_2 eq.	0.00	0.00	0.00	0.00	INA	38.9	0.00	1.28	-3380
ODP	kg CFC 11 eq.	0.00	0.00	0.00	0.00	INA	1.77E-10	0.00	1.41E-11	-2.26E-05
AP	kg SO_2 eq.	0.00	0.00	0.00	0.00	INA	0.126	0.00	0.0077	-32.3
EP	kg $(PO_4)^{3-}$ eq.	0.00	0.00	0.00	0.00	INA	0.0299	0.00	0.00105	-2.14
POCP	kg C_2H_4 eq.	0.00	0.00	0.00	0.00	INA	-0.0324	0.00	0.000749	-1.89
ADPE	kg Sb eq.	0.00	0.00	0.00	0.00	INA	2.51E-06	0.00	4.43E-07	-0.118
ADPF	MJ eq.	0.00	0.00	0.00	0.00	INA	535	0.00	16.7	-43000
GWP = Global Warming Potential (Climate Change); ODP = Ozone Depletion Potential; AP = Acidification Potential for Soil and Water; EP = Eutrophication Potential; POCP = Photochemical Ozone Creation; ADPE = Abiotic Depletion Potential – Elements; ADPF = Abiotic Depletion Potential – Fossil Fuels										
Resource use										
PERE	MJ	0.00	0.00	0.00	0.00	INA	28.8	0.00	1.96	-2210
PERM	MJ	0.00	0.00	0.00	0.00	INA	0.00	0.00	0.00	0.00
PERT	MJ	0.00	0.00	0.00	0.00	INA	28.8	0.00	1.96	-2210
PENRE	MJ	0.00	0.00	0.00	0.00	INA	537	0.00	17.3	-45200
PENRM	MJ	0.00	0.00	0.00	0.00	INA	0.00	0.00	0.00	0.00
PENRT	MJ	0.00	0.00	0.00	0.00	INA	537	0.00	17.3	-45200
SM	kg	0.00	0.00	0.00	0.00	INA	0.00	0.00	0.00	0.00
RSF	MJ	0.00	0.00	0.00	0.00	INA	0.00	0.00	0.00	0.00
NRSF	MJ	0.00	0.00	0.00	0.00	INA	0.00	0.00	0.00	0.00
FW	m^3	0.00	0.00	0.00	0.00	INA	72.2	0.00	3.53	-2330
PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used as raw materials; PENRT = Total use of non-renewable primary energy resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Net use of fresh water										
Waste to disposal										
HWD	kg	0.00	0.00	0.00	0.00	INA	3.84E-05	0.00	3.95E-07	8.32E-06
NHWD	kg	0.00	0.00	0.00	0.00	INA	0.0428	0.00	80.1	9.31
TRWD	kg	0.00	0.00	0.00	0.00	INA	0.000759	0.00	0.000241	-0.382
RWDHL	kg	0.00	0.00	0.00	0.00	INA	1.11E-06	0.00	3.06E-07	-5.98E-04
HWD = Hazardous waste disposed; NHWD = Non-hazardous waste disposed; TRWD = Total Radioactive waste disposed; RWDHL = Radioactive waste disposed (high-level nuclear waste)										
Other output flows										
CRU	kg	0.00	0.00	0.00	0.00	INA	0.00	0.00	0.00	0.00
MFR	kg	0.00	0.00	0.00	0.00	INA	0.00	920	0.00	0.00
MER	kg	0.00	0.00	0.00	0.00	INA	0.00	0.00	0.00	0.00
EE	MJ	0.00	0.00	0.00	0.00	INA	0.00	0.00	0.00	0.00
CRU = Components for reuse; MFR = Materials for recycling; MER = Materials for energy recovery; EE = Export energy										

Scenarios and Additional Technical Information

Module A4 – Transport to the building site				
Vehicle Type	**Fuel Consumption (L/km)**	**Distance (km)**	**Capacity Utilisation (%)**	**Density Of Product (kg/m³)**
Truck trailer	1.56	350	85	7850

Module A5 - Installation in the building			
Parameter	**Description**	**Unit**	**Value**
Ancillary materials for installation	Waste material from fabrication, losses per tonne of construction steel forms	%	2
Energy Use	Energy per tonne required to fabricate construction steel forms	kWh	15.34
Waste materials from installation wastage	Waste material from installation	%	10

Module B2 - Maintenance			
Parameter	**Description**	**Unit**	**Value**
Maintenance process description or source of information	No maintenance required	-	-

Module B3 - Repair			
Parameter	**Description**	**Unit**	**Value**
Repair process description or source of information	No repair process required	-	-

Module B4 – Replacement			
Parameter	**Description**	**Unit**	**Value**
Replacement cycle	No replacement considerations required	-	-

Module B5 - Refurbishment			
Parameter	**Description**	**Unit**	**Value**
Refurbishment process description or source of information	No refurbishment process required	-	-

Module B6 – Use of energy; and Module B7 – use of water			
Parameter	**Description**	**Unit**	**Value**
Other assumptions for scenario development, e.g., frequence of use, number of occupants	No use phase requirements of either water or energy required	-	-

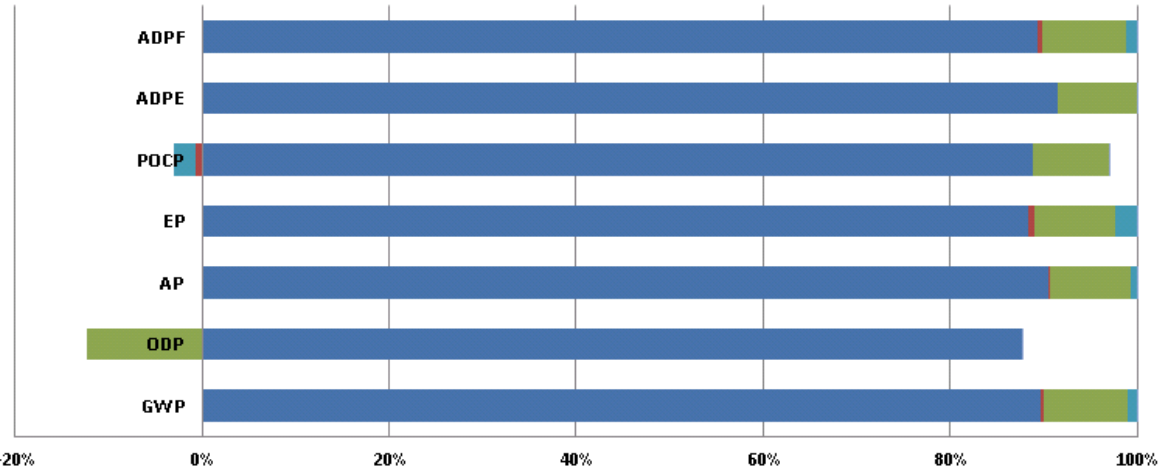
End-of-life modules – C1, C3, and C4			
Parameter	**Description**	**Unit**	**Value**
Waste for recycling	Recovered steel from crushed concrete	%	92
Waste for energy recovery	Energy recovery is not considered for this study as most end of life steel scrap is recycled, while the remainder is landfilled	-	-
Waste for final disposal	Unrecoverable steel lost in crushed concrete and sent to landfill	%	8
Other assumptions for scenario development, e.g, transportation	Portion of energy assigned to rebar from energy required to demolish building, per tonne	MJ	24

Module C2 – Transport to waste processing				
Vehicle Type	**Fuel Consumption (L/km)**	**Distance (km)**	**Capacity Utilisation (%)**	**Density Of Product (kg/m³)**
Truck	1.56	463	85	7850
Container ship	0.00401	158	50	7850

Module D – Reuse/Recovery/Recycling Potential
It is assumed that 92% of the steel used in the structure is recovered for recycling, while the remainder is landfilled. "Benefits and loads beyond the system boundary" (module D) accounts for the environmental benefits and loads resulting from net steel scrap that is used as raw material in the EAF and that is collected for recycling at end of life. The resulting scrap credit/burden is calculated based on the global "value of scrap" approach (/worldsteel 2011).

Interpretation

Scrap-based stainless steel rebar of Outokumpu Stainless Ltd (member of UK CARES) is made via the EAF route. The bulk of the environmental impacts and primary energy demand is attributed to the manufacturing phase, covered by information modules A1-A3 of EN 15804. For GWP for instance, A1-A3 impacts account for 89.6% overall life cycle impacts for this category.



	GWP	ODP	AP	EP	POCP	ADPE	ADPF
A1-3	89.60%	116.16%	90.48%	88.29%	94.34%	91.46%	89.26%
A4	0.39%	0.03%	0.19%	0.69%	-0.80%	0.00%	0.48%
A5	8.98%	-16.28%	8.65%	8.68%	8.71%	8.54%	8.99%
C1	0.05%	0.00%	0.02%	0.03%	0.03%	0.00%	0.06%
C2	0.95%	0.08%	0.62%	2.24%	-2.33%	0.00%	1.17%
C3	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
C4	0.03%	0.01%	0.04%	0.08%	0.05%	0.00%	0.04%

Figure 1

Sources of additional information

BRE Global. BRE Environmental Profiles 2013: Product Category Rules for Type III environmental product declaration of construction products to EN 15804:2012+A1:2013. PN 514. Watford, BRE, 2014.

BSI. Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products. BS EN 15804:2012+A1:2013. London, BSI, 2013.

BSI. Environmental labels and declarations – Type III Environmental declarations – Principles and procedures. BS EN ISO 14025:2010 (exactly identical to ISO 14025:2006). London, BSI, 2010.

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International Energy Agency, Energy Statistics 2013. http://www.iea.org

Kreißig, J. und J. Kuemmel (1999): Baustoff-Oekobilanzen. Wirkungsabschaftzung und Auswertung in der Steine-Erden-Industrie. Hrsg. Bundesverband Baustoffe Steine + Erden e.V.

London Metal Exchange, Steel Billet Prices, March 2014. https://www.lme.com/en-gb/metals/ferrous/

U.S. Geological Survey, Mineral Commodity Summaries, Iron and Steel Slag, January 2006

Sustainability of construction works – Environmental product declarations – Methodology for selection and use of generic data; German version CEN/TR 15941

REGULATION (EU) No 305/2011 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 9 March 2011 laying down harmonised conditions for the marketing of construction products and repealing Council Directive 89/106/EEC.

CARES SCS Sustainable Constructional Steel Scheme. Appendix 2 - Operational assessment schedule for the sustainable processing of steel products for the reinforcement of concrete & Appendix 4 - Operational assessment schedule for the sustainable production of stainless steel billets and stainless steel bars/coils for the reinforcement of concrete

CARES CP&AS (Construction Products and Associated Services) Scheme. Appendix 6 - Quality and operations assessment schedule for the processing and/or supply of stainless steel products for the reinforcement and use in concrete & Appendix 16 - Quality and operations assessment schedule for stainless steel bar and coil for the reinforcement of concrete including inspection and testing requirements - http://www.ukcares.com/approved-companies - Certificate number of conformance to BS6744 at the time of LCA study – 090901

BS 6744:2016 Stainless steel bars. Reinforcement of concrete. Requirements and test methods.

ASTM A955 / A955M – 16 Standard Specification for Deformed and Plain Stainless-Steel Bars for Concrete Reinforcement