Environmental Product Declaration

EPD of multiple products, based on the average results of the product group in accordance with ISO 14025:2006 and EN 15804:2012+A2:2019/AC:2021 for:

Recovered and reused mill surplus stock tubulars, mill downgrade and field surplus steel tubulars.

Interpipe, Inc.

Programme:	The International EPD® System, www.environdec.com
Programme operator:	EPD International AB; this EPD is registered through aligned regional hub: EPD North America (www.epdna.com)
EPD registration number:	EPD IES-0020366
Publication date:	*2025-04-23*
Valid until:	*2030-04-22*

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

General information

Programme information

Programme:	The International EPD® System.
Address:	EPD International AB Box 210 60 SE-100 31 Stockholm Sweden
Website:	www.environdec.com
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Accountabilities for PCR, LCA and independent, third-party verification
Product Category Rules (PCR)
CEN standard EN 15804 serves as the Core Product Category Rules (PCR)
Product Category Rules (PCR): Construction Products. PCR 2019:14. Version 1.3.4 Valid Until: 2025-06-20
PCR review was conducted by: The Technical Committee of the International EPD System. See www.environdec.com for a list of members. Review chair: Claudia A. Peña, University of Concepción, Chile. The review panel may be contacted via the Secretariat www.environdec.com/
Life Cycle Assessment (LCA)
LCA accountability: Mark Dowling and Robert Holdway - Giraffe Innovation Ltd r.holdway@giraffeinnovation.com
Third-party verification
Independent third-party verification of the declaration and data, according to ISO 14025:2006, via: ☒ EPD verification by individual verifier Third-party verifier: Matt Fishwick - Fishwick Environmental Approved by: The International EPD® System
Procedure for follow-up of data during EPD validity involves third party verifier: ☐Yes **x** No

The EPD owner has the sole ownership, liability, and responsibility for the EPD.

EPDs within the same product category but registered in different EPD programmes, or not compliant with EN 15804, may not be comparable. For two EPDs to be comparable, they must be based on the same PCR (including the same version number) or be based on fully-aligned PCRs or versions of PCRs; cover products with identical functions, technical performances and use (e.g. identical declared/functional units); have equivalent system boundaries and descriptions of data; apply equivalent data quality requirements, methods of data collection, and allocation methods; apply identical cut-off rules and impact assessment methods (including the same version of characterisation factors); have equivalent content declarations; and be valid at the time of comparison. For further information about comparability, see EN 15804 and ISO 14025.

EPDs of construction products may not be comparable if they do not comply with EN 15804+A2.

Company information

Interpipe inc.
3320 Miles Rd,
Hamilton,
ON L0R 1W0,
Canada

Website: https://interpipe.com/

Description of the organisation:
Interpipe, Inc., has specialized in the supply of steel products to the energy industry worldwide for nearly 50 years. Founded in Houston, Texas in 1976, Interpipe is committed to providing quality steel pipe and products to meet and exceed international standards.

Name and location of production sites

Ontario	**Québec**	**Alberta**
3320 Miles Road	805 1st Avenue	4003 46 Street
Mt. Hope Ontario	Sainte Catherine, Québec	PO Box 28
LOR 1W0	J5C 1C5	Millet, Alberta
Canada	Canada	T0C 1Z0
		Canada

Product information

Product name and identification: Repurposed tubular steel sourced from unused pipe mill reject, mill downgrade and surplus stock.

Product description: The electric resistance welded EAF steel mill surplus stock tubulars, mill downgrade and field surplus steel tubulars are collected from sites across Canada.

Each structural steel pipe range in sizes, but the average is 40 feet long with a 24 inches diameter and 0.375-inch wall thickness. Uncoated it weighs 1.894 net tons. In 2024 no coated pipes were supplied to the three sites.

The tubulars receive limited treatment apart from inspection and grading. However, some may require to be cut, bevelled, welded, shot blasted or painted if required and then supplied to the customer.

UN CPC code: 4128 – Tubes, pipes and hollow profiles of steel.

Geographical scope: The tubulars are recovered from within Canada and shipped to Hamilton, Millet and Québec sites.

LCA information

Declared unit: The declared unit is 1 metric tonne of recovered and reused mill surplus stock tubulars; mill downgrade and field surplus steel tubulars. This is a weighted aggregated data set based upon the weight of tubulars recovered, between the three Interpipe sites, and refurbished in 2024.

These tubulars are deemed as production co-products and are not burden free. The burden associated with them is based upon their residual value compared to a new (prime steel) tubular of the same weight (essentially the secondary market price paid versus the price for new mill prime steel).

Reference service life: A reference service life for steel tubulars is not declared because they can be used in a variety of different forms of construction, and the final construction application is not defined. To determine the full-service life, all factors would need to be included such as location and environment, corrosion, and fire protection. Typical construction foundation designs are for lifespans of 50-100 years.

Time representativeness: Covers one year for 1st January 2024 to 31st December 2024.

Database(s) and LCA software used: databases ecoinvent v3.10 (cut-off) and World Steel Association (WSA), and LCA software SimaPro 9.6.0.1.

EPD type: The EPD type is an EPD of multiple products, based on the average results of the product group. Allocation of different sizes was carried out on a mass basis, so there is no difference in per tonne impact.

LCA methodology
EN 15804 reference package based on EF 3.1 was used.

Description of system boundaries: Cradle to gate (A1-A3) with modules A5, C1–C4 and module D (A1–A3, A5, C and D). The EPD includes the initial recovery and refurbishment of a tube that has been recovered as surplus or downgraded pipeline product. A5 is declared for disposal of the packing materials for the purpose of balancing the biogenic carbon stored in the wood dunnage and it does not include the impact of installation.

During refurbishment, the tubular might be cut, bevelled, welded, shot blasted or painted if required and then supplied to the client. The system boundary (Figure 1) begins at the collection site.

System Diagram

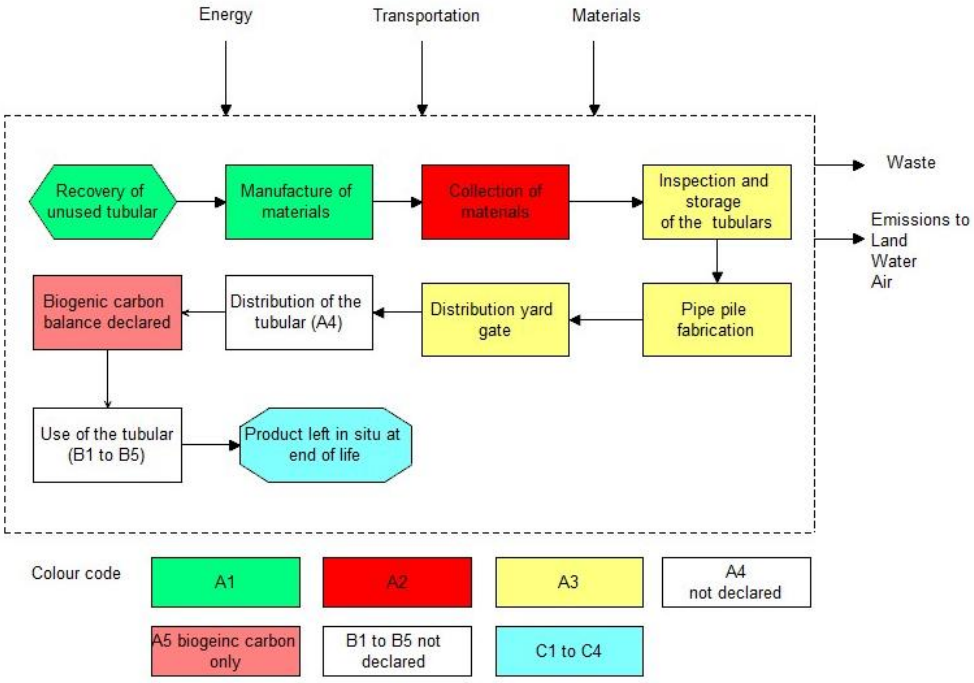

Figure 1: System boundary

Based upon the tonnage collected in 2024 and the distance travelled by road haulage the average distance and mode of transport is given (Table 1) and information on manufacturing given in Table 2. The end-of-life scenario is given in Table 3. There are also a variety of consumables purchased for working on the tubulars including welding gases, grinding wheels and welding wire.

Table 1: Average transport to Interpipe site (A2)

Scenario information	Unit
Vehicle used	Class 8 20 ton
Vehicle fuel type	Diesel
Average road distance to site	209 km (130miles)
Bulk density and capacity utilisation	Varies considerably so tkm from ecoinvent used for each relevant mode of transport

Table 2: A3 scenario information

A3 Scenario information	Unit
Site fuel use per tonne of tubular	Diesel 6.94 kg
Electricity per tonne of tubular	8.24 kWh
Water	0.0013m^3

The tubes are typically installed on site and driven into the ground by diesel construction equipment but this is not declared in this EPD.

Table 3: C4 disposal

End of life Scenario information	Unit
Left it situ	1 tonne of tube

Assumption and estimates

For transportation of the tube from the supplier to Interpipe is modelled as a weighted average based upon the total annual purchased in tonnes from 13 different sites. This resulted in an average transportation distance of 209 km by road.

The impact of the tubular itself is based upon the average price paid compared to a new equivalent (prime steel) in 2024. This was based upon a detailed spreadsheet of costs of new and mill rejects supplied by Interpipe plus an average of the energy and consumables used. Therefore, the GWP of the tubular is 936.33 kgCO_2eq per tonne. This applies to 100% of the purchased tubulars for this EPD.

As the tubulars are left *in situ* after use, which could by as long as 100 years (e.g., for deep foundation piling), the degradation will be minimal due to the anaerobic conditions.

Cut off Rules

When building a life cycle inventory (LCI), it is typical to exclude items considered to have a negligible contribution to results. To do this in a robust manner there must be confidence that the exclusion is fair and reasonable. Therefore, cut-off criteria are defined, which allow items to be neglected if they meet the criteria. In this study exclusions could be made if they were expected to be within the below criteria:

- The LCI data shall be a minimum of 95% of total inflows (mass and energy) per module (e.g. A1-A3, A5, C1-C4 and module D)
- This EPD applies the expanded cut-off rule of ISO 21930, which says that at least 95% of the environmental impact per module shall be included as well. Plausibility assessments and expert judgement can be used to demonstrate compliance with these criteria.

Data quality indicators (DQIs)

To ensure data quality, checks were completed on key data parameters using data quality indicators (DQIs) which are applied to key data parameters to ensure fit for purpose. Key data parameters are assessed against a data quality matrix. The data quality matrix used in this study is shown (Table 4) and the scoring for the data is highlighted in grey.

Table 4: Data quality indicators

Score	Very good	Good	Fair	Poor	Very poor
Reliability of the source	Verified data based on measurements	Verified data partly based on assumptions or unverified data based on measurements	Non-verified data partly based on assumptions	Qualified estimate (e.g., by industrial expert)	Non-qualified estimate
Representative	Representative data from sufficient sample of sites over an adequate period to even out normal fluctuations	Representative data from a smaller number of sites but for adequate periods	Representative data from an adequate number of sites but from shorter periods	Representative data but from a smaller number of sites and shorter periods or incomplete data from an adequate number of sites and periods	Representativeness unknown or incomplete data from a smaller number of sites and/or from shorter periods
Temporal correlation	Less than three years of difference to year of study	Less than six years of difference	Less than 10 years of difference	Less than 15 years of difference	Age of data unknown or more than 15 years of difference
Geographical correlation	Data from area under study	Average data from larger area in which the area under study is included	Data from area with similar production conditions	Data from area with slightly similar production conditions	Data from unknown area or area with very different production conditions
Technological correlation	Data from enterprises, processes, and materials under study	Data from processes and materials under study but from different enterprises	Data from processes and materials under study but from different technology	Data on related processes or materials but same technology	Data on related processes or materials but different technology

Life cycle stages that have been omitted from the scope of the study include the following:

- Human energy inputs to processes;
- Infrastructure and capital goods;
- Transport of employees to and from their normal place of work.

The estimated impact results are only relative statements which do not indicate the end points of the impact categories, exceeding threshold values, safety margins or risks.

Modules declared, geographical scope, share of specific data (in GWP-GHG results) and data variation (in GWP-GHG results):

Table 5: Modules declared

	Product stage			Construction process stage		Use stage							End of life stage				Resource recovery stage
	Raw material supply	Transport	Manufacturing	Transport	Construction installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
Module	**A1**	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
Modules declared	X	X	X	ND	X	ND	ND	ND	ND	ND	ND	ND	X	X	X	X	X
Geography	GLO	CA	CA	-	CA	ND	ND	ND	ND	ND	ND	ND	CA	CA	CA	CA	
Share of specific data	<1%			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation – products	0%			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation – sites*	+21/ -24%			-	-	-	-	-	-	-	-	-	-	-	-	-	-

X included in LCA - ND: module not declared – CA: Canada – GLO : global

*The data variation from the three sites is primarily due to the differences in the original impact of the recovered tubulars (A1) and the distance the recovered tubulars travel to the Interpipe site for processing (A2).

Product and packaging content information

Table 6: Product and packaging information

Product components	**Weight, kg**	**Post-consumer material, weight-%**		**Biogenic material, weight-% and kg C/kg**
Hot rolled steel	1000	0[1]		0%
Packaging			**Weight-% (versus the product)**	
Wood blocks and sleepers	2	0	0.2%	50% and 1 kg C/kg

The product does not contain any substances from the Candidate List of Substances of Very High Concern (SVHC) for authorisation in amounts greater than 0.1%.

Electricity use

The site-specific electricity mix was used, as no residual values were available. The impact of the electricity used in A3 was well below 1% of the A1 to A3 carbon footprint. The contribution is very small and using a residual mix would not change the results. The reference year for electricity was 2024 and the weighted impact per kWh was 0.610 kgCO_2eq. The breakdown of the electricity per site is given below (Table 7).

[1] The tubular is 100% pre consumer reused material.

Table 7: Site grid electricity sources

Electricity source	Millet	Hamilton	Quebec
Hydro	4%	23%	79%
Coal	27%	0%	0%
Natural gas	50%	6%	0%
Wind	10%	7%	5%
Import	9%	9%	16%
Wood chip	1%	<1%	0%
Nuclear	0%	55%	0%
Other	<1%	<1%	1%

Results of the environmental performance indicators

The estimated impact results are only relative statements which do not indicate the end points of the impact categories, exceeding threshold values, safety margins or risks.

Product average based upon weighted average of annual production.

The only difference in the products is where it is sourced from (A1-A3).

Mandatory impact category indicators according to EN 15804

Table 8: Results of mandatory environmental performance indicators

Results per 1 metric tonne of recovered and repurposed tubular steel								
Indicator	**Unit**	**A1-A3**	**A5**	**C1**	**C2**	**C3**	**C4**	**D**
Climate change	kg CO_2 eq	9.80E+02	2.95E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Climate change - Fossil	kg CO^2 eq	9.72E+02	3.29E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Climate change - Biogenic	kg CO_2 eq	2.53E+00	2.92E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Climate change - Land use and LU change	kg CO_2 eq	5.47E+00	8.85E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ozone depletion	kg CFC11 eq	1.57E-05	3.76E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Acidification	mol H+ eq	8.66E+00	3.33E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Eutrophication, freshwater	kg P eq	6.19E-01	1.41E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Eutrophication, marine	kg N eq	9.73E-01	1.73E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Eutrophication, terrestrial	mol N eq	9.92E+00	1.66E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Photochemical ozone formation	kg NMVOC eq	3.63E+00	4.20E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Resource use, minerals and metals	kg Sb eq	3.79E-02	5.99E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Resource use, fossils	MJ	1.25E+04	2.90E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Water use	m^3 depriv.	6.55E+02	1.37E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Acronyms
GWP-fossil = Global Warming Potential fossil fuels; GWP-biogenic = Global Warming Potential biogenic; GWP-luluc = Global Warming Potential land use and land use change; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential, Accumulated Exceedance; EP-freshwater = Eutrophication potential, fraction of nutrients reaching freshwater end compartment; EP-marine = Eutrophication potential, fraction of nutrients reaching marine end compartment; EP-terrestrial = Eutrophication potential, Accumulated Exceedance; POCP = Formation potential of tropospheric ozone; ADP-minerals & metals = Abiotic depletion potential for non-fossil resources; ADP-fossil = Abiotic depletion for fossil resources potential; WDP = Water (user) deprivation potential, deprivation-weighted water consumption

** Disclaimer: The results of this environmental impact indicator shall be used with care as the uncertainties of these results are high or as there is limited experience with the indicator.*

The use of the results of modules A1-A3 without considering the results of module C is discouraged as end of life may vary for other reuse applications.

Additional mandatory and voluntary impact category indicators

Table 9: Results of additional environmental performance indicators

Results per 1 metric tonne of recovered and repurposed tubular steel								
Indicator	**Unit**	**A1-A3**	**A5**	**C1**	**C2**	**C3**	**C4**	**D**
Particulate matter	disease inc.	1.25E-04	3.72E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ionising radiation	kBq U-235 eq	1.22E+02	3.55E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ecotoxicity, freshwater	CTUe	9.26E+03	1.94E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Human toxicity, cancer	CTUh	1.49E-05	1.32E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Human toxicity, non-cancer	CTUh	5.65E-01	3.92E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Land use	Pt	8.18E+03	9.16E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
GWP - GHG	kg CO_2 eq	9.78E+02	3.29E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Disclaimers

*This impact category deals mainly with the eventual impact of low dosing ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure, nor due to radiative waste in underground facilities. Potential ionizing radiation from soil, from radon and from some materials is also not measured by this indicator.

** The results of these environmental impact indicators should be used with care as the uncertainties of these results are high or as there are limited experiences with the indicator.

Resource use indicators

Table 10: Resource use indicators

Results per 1 metric tonne of recovered and repurposed tubular steel								
Indicator	**Unit**	**A1-A3**	**A5**	**C1**	**C2**	**C3**	**C4**	**D**
PERE	MJ	4.64E-01	7.53E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERM	MJ	2.00E+03	-3.01E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	MJ	**2.00E+03**	**-3.01E+01**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**
PENRE	MJ	1.72E+02	3.15E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRM	MJ	1.32E+04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	MJ	**1.34E+04**	**3.15E-01**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**
SM	kg	1.00E+03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	m^3	4.18E+01	4.27E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Acronyms

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 re-sources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water

Waste indicators

Table 11: Waste indicators

Results per 1 metric tonne of recovered and repurposed tubular steel								
Indicator	**Unit**	**A1-A3**	**A5**	**C1**	**C2**	**C3**	**C4**	**D**
Hazardous waste disposed	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Non-hazardous waste disposed	kg	4.54E-02	2.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Radioactive waste disposed	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Output flow indicators

Table 12: Output flow indicators

Results per 1 metric tonne of recovered and repurposed tubular steel								
Indicator	**Unit**	**A1-A3**	**A5**	**C1**	**C2**	**C3**	**C4**	**D**
Components for re-use	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Material for recycling	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for energy recovery	kg	0.00E+00	2.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy, electricity	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy, thermal	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Additional environmental information

The materials accounted for in Raw Material Supply (A1) are the consumables used in moving the tubulars on site and the wooden blocks used to wedge the tubulars in place to prevent movement.

The transportation impacts in Transport (A2) are based upon 2024 data on weights of tubulars recovered from sites across Canada.

The tubulars will typically be used in building foundation piling and last as long as the building remains in place. At end of life the life of the building the tubulars are left in situ as they-are pile driven. There is potential for recovery and reuse but this is currently unlikely.
Reuse-Recovery-Recycling Potential (D) has been modelled to identify the potential benefits of recovering the tubulars as scrap metal. As the tubulars are not generally recovered C1 to C4 and D are all 0.

Alternative application end of life scenario

This EPD also provides the alternative scenario analysis for tubulars used in structural applications (above ground) such as members in buildings where the recovery reuse and recycling are more likely at end of life.

For this alternative end of life scenario, it was assumed that the tubulars are removed from a demolition site and that 2.555 kg (11kWh) of diesel is used per tonne of extracted tubular (Erlandsson, M., & Pettersson, D. 2015). It was also assumed that a local contractor removes the tubular, and it travels 50 km for end-of-life treatment of which 980 kg (98%) are recycled and 20 kg (2%) are landfilled. This is based upon AISC data for the recovery of steel by the construction industry [2].

In D the benefits of reuse and recycling are based upon the assumption that 466kg of tubulars are reused and 466kg of the tubulars are recycled. The reused benefit is based upon the impact of the production of 500kg of pipe. The recycling is based upon the value of scrap steel.

[2] https://www.aisc.org/why-steel/sustainability/recycling/#:~:text=Structural%20steel%20produced%20in%20the,loss%20of%20its%20physical%20properties.

Product average based upon weighted average of annual production.

The only difference in the products is from where it is sourced (A1-A3).

Mandatory impact category indicators according to EN 15804

Table 13: Results of mandatory environmental performance indicators (alternative end-of-life scenario)

Results per 1 metric tonne of recovered and repurposed tubular steel								
Indicator	**Unit**	**A1-A3**	**A5**	**C1**	**C2**	**C3**	**C4**	**D**
Climate change	kg CO_2 eq	9.80E+02	2.95E+00	2.18E+00	9.59E+00	1.75E+00	4.26E-01	-1.76E+03
Climate change - Fossil	kg CO^2 eq	9.72E+02	3.29E-02	2.18E+00	9.58E+00	1.75E+00	4.25E-01	-1.76E+03
Climate change - Biogenic	kg CO_2 eq	2.53E+00	2.92E+00	9.81E-04	2.80E-04	-1.29E-03	5.86E-05	1.54E-01
Climate change - Land use and LU change	kg CO_2 eq	5.47E+00	8.85E-06	5.89E-04	3.89E-03	1.93E-03	2.19E-04	-1.95E-01
Ozone depletion	kg CFC11 eq	1.57E-05	3.76E-10	1.59E-07	1.42E-07	1.15E-08	1.23E-08	-2.00E-12
Acidification	mol H+ eq	8.66E+00	3.33E-04	9.70E-03	2.20E-02	9.29E-03	3.01E-03	-3.95E+00
Eutrophication, freshwater	kg P eq	6.19E-01	1.41E-05	1.22E-04	7.58E-04	7.07E-04	3.53E-05	-4.79E-04
Eutrophication, marine	kg N eq	9.73E-01	1.73E-04	1.54E-03	5.10E-03	1.98E-03	1.15E-03	-7.32E-01
Eutrophication, terrestrial	mol N eq	9.92E+00	1.66E-03	1.64E-02	5.51E-02	2.05E-02	1.25E-02	-7.19E+00
Photochemical ozone formation	kg NMVOC eq	3.63E+00	4.20E-04	1.90E-02	3.07E-02	6.05E-03	4.49E-03	-2.94E+00
Resource use, minerals and metals	kg Sb eq	3.79E-02	5.99E-08	1.65E-06	3.13E-05	8.97E-06	6.64E-07	-1.56E-03
Resource use, fossils	MJ	1.25E+04	2.90E-01	1.34E+02	1.35E+02	2.12E+01	1.04E+01	-1.79E+04
Water use	m^3 depriv.	6.55E+02	1.37E-02	1.61E-01	6.13E-01	2.60E-01	4.56E-01	-3.27E+03

Acronyms
GWP-fossil = Global Warming Potential fossil fuels; GWP-biogenic = Global Warming Potential biogenic; GWP-luluc = Global Warming Potential land use and land use change; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential, Accumulated Exceedance; EP-freshwater = Eutrophication potential, fraction of nutrients reaching freshwater end compartment; EP-marine = Eutrophication potential, fraction of nutrients reaching marine end compartment; EP-terrestrial = Eutrophication potential, Accumulated Exceedance; POCP = Formation potential of tropospheric ozone; ADP-minerals & metals = Abiotic depletion potential for non-fossil resources; ADP-fossil = Abiotic depletion for fossil resources potential; WDP = Water (user) deprivation potential, deprivation-weighted water consumption

** Disclaimer: The results of this environmental impact indicator shall be used with care as the uncertainties of these results are high or as there is limited experience with the indicator.*

The use of the results of modules A1-A3 without considering the results of module C is discouraged as end of life may vary for other reuse applications.

Additional mandatory and voluntary impact category indicators

Table 14: Results of additional environmental performance indicators (alternative end-of-life scenario)

Results per 1 metric tonne of recovered and repurposed tubular steel								
Indicator	**Unit**	**A1-A3**	**A5**	**C1**	**C2**	**C3**	**C4**	**D**
Particulate matter	disease inc.	1.25E-04	3.72E-09	8.39E-08	7.14E-07	9.82E-08	6.85E-08	-7.52E-05
Ionising radiation	kBq U-235 eq	1.22E+02	3.55E-04	3.25E-02	1.12E-01	1.61E-01	6.65E-03	4.15E+03
Ecotoxicity, freshwater	CTUe	9.26E+03	1.94E+00	8.52E+00	3.61E+01	5.79E+00	1.43E+00	-1.55E+03
Human toxicity, cancer	CTUh	1.49E-05	1.32E-08	9.06E-09	5.03E-08	4.50E-09	1.92E-09	-6.52E-07
Human toxicity, non-cancer	CTUh	5.65E-01	3.92E-09	1.08E-08	8.44E-08	1.51E-08	1.78E-09	-1.22E-06
Land use	Pt	8.18E+03	9.16E-02	8.47E+00	8.15E+01	1.76E+01	2.05E+01	-4.61E+02
GWP GHG	kg CO_2 eq	9.78E+02	3.29E-02	2.18E+00	9.59E+00	1.75E+00	4.26E-01	-1.76E+03

Disclaimers

*This impact category deals mainly with the eventual impact of low dosing ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure, nor due to radiative waste in underground facilities. Potential ionizing radiation from soil, from radon and from some materials is also not measured by this indicator.

** The results of these environmental impact indicators should be used with care as the uncertainties of these results are high or as there are limited experiences with the indicator.

Resource use indicators

Table 15: Resource use indicators (alternative end-of-life scenario)

Results per 1 metric tonne of recovered and repurposed tubular steel								
Indicator	**Unit**	**A1-A3**	**A5**	**C1**	**C2**	**C3**	**C4**	**D**
PERE	MJ	4.64E-01	7.53E-03	3.84E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERM	MJ	2.00E+03	-3.01E+01	0.00E+00	1.33E+00	-2.31E+00	8.19E-02	-9.42E+01
PERT	MJ	**2.00E+03**	**-3.01E+01**	**3.84E-01**	**1.33E+00**	**-2.31E+00**	**8.19E-02**	**-9.42E+01**
PENRE	MJ	1.72E+02	3.15E-01	1.42E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRM	MJ	1.32E+04	0.00E+00	0.00E+00	1.43E+02	-2.26E+01	1.11E+01	-1.91E+04
PENRT	MJ	**1.34E+04**	**3.15E-01**	**1.42E+02**	**1.43E+02**	**-2.26E+01**	**1.11E+01**	**-1.91E+04**
SM	kg	1.00E+03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	m^3	4.18E+01	4.27E-04	5.70E-03	1.85E-02	8.49E-03	1.09E-02	-7.64E+00

Acronyms

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 re-sources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water

Waste indicators

Table 16: Waste indicators (alternative end-of-life scenario)

Results per 1 metric tonne of recovered and repurposed tubular steel								
Indicator	**Unit**	**A1-A3**	**A5**	**C1**	**C2**	**C3**	**C4**	**D**
Hazardous waste disposed	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Non-hazardous waste disposed	kg	4.54E-02	2.00E+00	0.00E+00	0.00E+00	0.00E+00	2.00E+01	0.00E+00
Radioactive waste disposed	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Output flow indicators

Table 17: Output flow indicators (alternative end-of-life scenario)

Results per 1 metric tonne of recovered and repurposed tubular steel								
Indicator	**Unit**	**A1-A3**	**A5**	**C1**	**C2**	**C3**	**C4**	**D**
Components for re-use	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Material for recycling	kg	0.00E+00	2.00E+00	0.00E+00	0.00E+00	0.00E+00	9.80E+02	9.32E+02
Materials for energy recovery	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy, electricity	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy, thermal	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

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