Environmental Product Declaration

In accordance with ISO 14020:2022, 14025:2006, EN 15804:2012+A2:2019/AC:2021 and EN 16783:2017 for:

Pre-insulated single steel pipes and fittings

from

Set ehf/GmbH

EPD of multiple products, based on a representative product.

Programme:	The International EPD® System, www.environdec.com
Programme operator:	EPD International AB
EPD registration number:	S-P-12359
Publication date:	2024-02-08
Valid until:	2029-02-07

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
EPD of multiple products, based on worst-case results

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
E-mail:	info@environdec.com

Accountabilities for PCR, LCA and independent, third-party verification
Product Category Rules (PCR)
CEN standards EN 15804:2012+A2:2019/AC:2021 and EN 16783:2017 serve as the Core Product Category Rules (PCR)
Product Category Rules (PCR): *Construction Products, 2019:14, version 1.3.2* *Thermal Insulation Products, c-PCR-005* *UN CPC 41287*
PCR review was conducted by: *The Technical Committee of the International EPD® System*
Life Cycle Assessment (LCA)
LCA accountability: *Hafliði Eiríkur Guðmundsson, Ingibjörg Andrea Bergþórsdóttir, Nicolas Marino Proietti, ReSource International*
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: *Prof. Ing. Vladimír Kočí, Ph.D., MBA* *LCA Studio* *vlad.koci@vscht.cz* *www.lcastudio.cz* Approved by: The International EPD® System
Procedure for follow-up of data during EPD validity involves third party verifier: ☐ Yes ☒ 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.

Company information

Owner of the EPD: Set ehf,/GmbH Eyravegur 41, 800 Selfoss, Iceland
https://setpipes.eu/
sala@set.is
+354 480 2700
Contact: Valdimar Hjaltason
Description of the organisation: Steypuiðjan, which later became Set, was founded in 1968 with the production of concrete sewer pipes and a decade later, insulated steel pipes for district heating. A wide range of other pipes and piping systems have followed, with all production taking place in 2 factories, Set in Selfoss, Iceland and Set Pipes in Germany. The last four decades have seen a very active and competitive market environment and circumstances have called for vigilance and rapid response where the emphasis has been placed on a high level of technology, productivity and quality control. Great knowledge and experience has evolved in the field of manufacturing technology within the company. This also applies to knowledge in the field of marketing and services for pipeline industries.
Product-related or management system-related certifications: ÍST EN ISO 9001:2015, ÍST EN ISO 14001:2015, EHP001 Straight Pipes (quality certification from Euroheat & Power).
Name and location of production site(s): Set Selfossi, Eyravegur 41, 800 Selfoss, Iceland.

Product information

Product name: Pre-insulated single steel pipes and fittings.
Product identification:
Pre-insulated single steel pipes and fittings from Set ehf./GmbH are manufactured in accordance with the following European standards:
EN 253 - District heating pipes – Pre-insulated bonded pipe systems for directly buried hot water networks - Pipe assembly of steel service pipe, polyurethane thermal insulation and outer casing of polyethylene.
EN 448 - District heating pipes – Pre-insulated bonded pipe systems for directly buried hot water networks – Fitting assemblies of steel service pipes, polyurethane thermal insulation and outer casing of polyethylene.

EN 488 - District heating pipes – Pre-insulated bonded pipe systems for directly buried hot water networks - Steel valve assembly for steel service pipes, polyurethane thermal insulation and outer casing of polyethylene.
EN 489 - District heating pipes – Pre-insulated bonded pipe systems for directly buried hot water networks - Joint assembly for steel service pipes, polyurethane thermal insulation and outer casing of polyethylene.
EN 13941 - Design and installation of pre-insulated bonded pipe systems for district heating.
EN 14419 - District heating pipes – Pre-insulated bonded pipe systems for directly buried hot water networks – Surveillance systems.
EN 15698 - District heating pipes – Pre-insulated bonded twin pipe systems for directly buried hot water networks.
EN ISO 9001 - Quality management systems.
EN ISO 14001 - Environmental management systems.
AGFW FW 401 - Design and installation of pre-insulated bonded pipes for district heating networks.

Product description: Pre-insulated single steel pipes and fittings are insulated with polyurethane foam (PUR) and encased in a high-density polyethylene (HDPE) outer layer. The pipes feature a rigid connection system, ensuring a seamless bond between the steel pipe, PUR-foam, and HDPE casing. Available in lengths of 6, 12, and 16 meters, these pipes come in various dimensions ranging from DN 20 to 800 across insulation series 1, 2, and 3. Casing diameters range from 90 – 1000 mm. The representative pipe described in this EPD has DN 32 and a casing diameter of 110 mm.
The R-value of the product is CI, which stands for civil engineering applications. The R-value is stated in accordance with EN 16783:2017.
Primarily used for district heating fluid transportation, the pre-insulated single steel pipes and fittings are installed underground. However, their HDPE casing is infused with carbon black to enhance durability against sunlight, making them suitable for above ground applications when necessary.
Set sources steel pipes exclusively from ISO 9001 certified suppliers, ensuring high quality. On request, they provide an inspection certificate to verify material standards. The PUR-foam used in these pipes has excellent insulation properties (2.60 E-02 W/m-K), high-pressure resistance and longevity. The PUR-foam is cyclopentane-blown and has zero effect on the ozone layer. This foam also plays a crucial role in firmly bonding the steel pipes to the plastic casing. The PE casing is robust, offering substantial resistance to chemical degradation and sunlight, making it an ideal protective layer for the PUR foam. The pipes are manufactured seamlessly, and the polyethylene surface is corona treated to maximize adhesion to the PUR foam.

Properties of steel in pipes

Technical requirements:	P235GH TC1 according to EN 10217-2 and 5, > DN 100 P235TR1 according to EN 10217-1 DN 20 - 80
Dimensions and wall thickness:	EN 10220
Bevelling:	EN ISO 9692-1
Inspection certificate:	EN 10204-3,1

Properties of PUR in pipes

Cell size and amount:	< 5% of the insulations cross section according to EN 253 Chapter 4.4.2

Compression strength:	> 0,30 MPa at 10% deflection according to EN 253 chapter 4.4.3
Thermal conductivity:	For Set Pre - insulated steel pipes and fittings: 0,026 W/m·K Requirements from EN 253 chapter 4.5.6: < 0,029 W/m·K
Heat resistance (CCOT):	161°C/30 years for PUR insulation 175°C/30 years for PIR insulation > 130°C/30 years, minimum requirements according to EN 253 chapter 4.5.5.1
Shear strength:	EN 253 chapter 4.5.5.2
Insulation axial shear strength:	> 0,12 MPa at 23°C, chapter 5.4.1.4
Radial shear strength:	> 0,20 MPa at 140°C, chapter 5.4.2
Water absorption:	< 10% water absorption of sample mass according to EN 253 chapter 4.4.5

Properties of HDPE in pipes

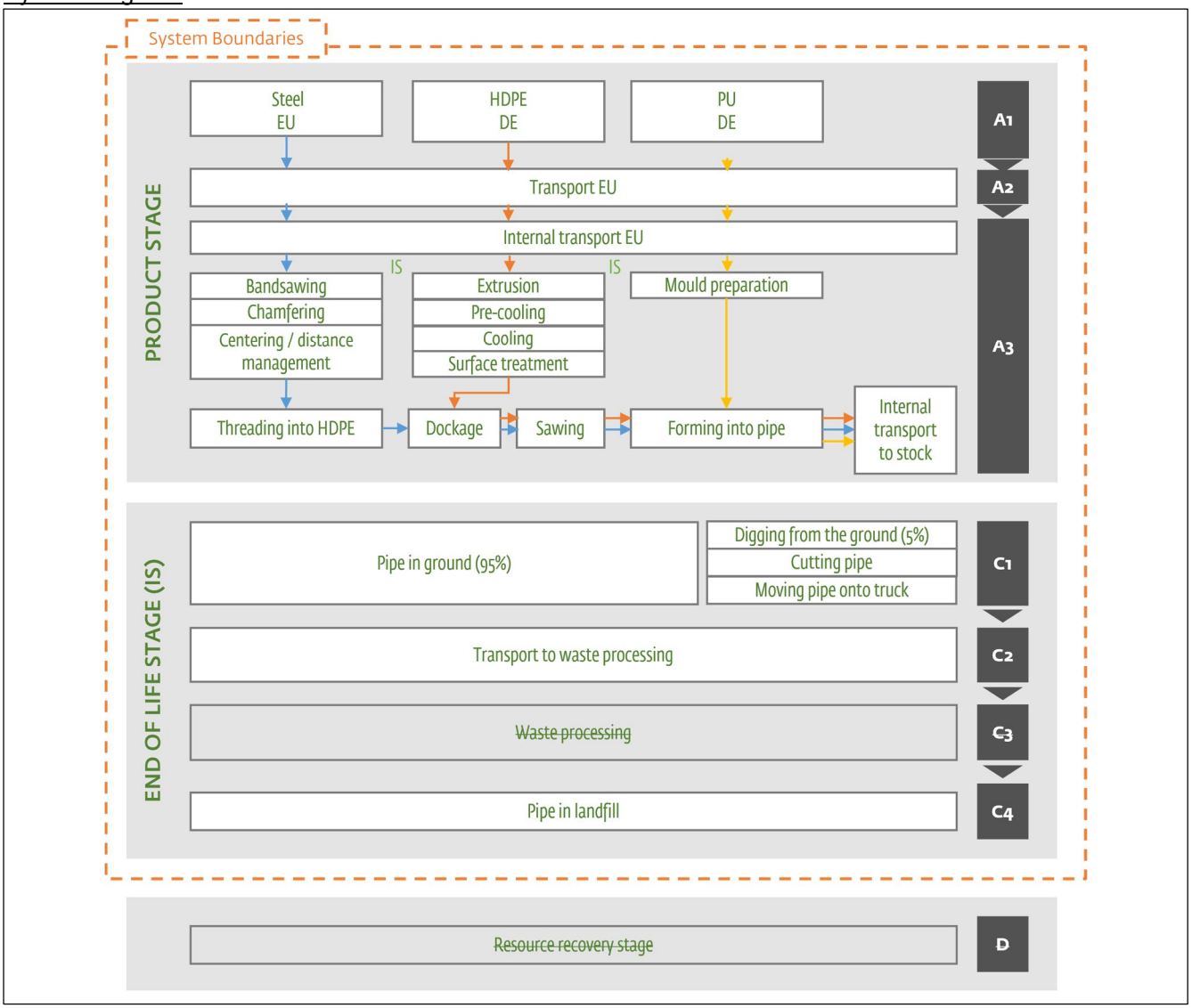
Material:	Polyethylene – PE100
Color:	Carbon black > 2,5 % of the mass according to EN 253 Chapter 4.3.1.1
Material properties:	EN 253 Chapter 4.3.1.1
Minimum wall thickness:	EN 253 Chapter 4.3.2.2 Table 5
Thermal conductivity:	0,40 W/m·K
Melt flow index:	0,20 - 1,4 g/10 min. according to EN 253 Chapter 4.3.1.2

UN CPC code: UN CPC 41287
Geographical scope:
A1: Europe, mainly continental, as the raw material which Set uses are produced there.
A2: Europe, mainly continental Europe.
A3: Europe and the Atlantic Ocean for transport between Set premises, Selfoss in Iceland for production.
C1-C4: Iceland, as the pipes are predominantly sold within Iceland.
D: Not applicable as pipes in Iceland are generally left in the ground (in some cases landfilled though).

LCA information

Functional unit / declared unit: 1 meter (representative product is 3.98 kg).
The representative product has the product number 1.102.032, which was chosen based on sales.
Time representativeness: 2020
Database(s) and LCA software used: Ecoinvent 3.9.1, openLCA 2.0.1
Description of system boundaries:
Cradle to gate with modules C1–C4 and module D (A1–A3 + C + D). However, as the pipes are generally left in the ground in Iceland, and in some cases landfilled, there are no environmental impacts recorded for module D. The proportion of the pipes which goes to landfill is assumed not to be processed in any way, and therefore there are no environmental impacts recorded in C3.

System diagram:



Electricity consumption:

Electricity used by Set in their production processes was modelled on the residual electricity mix of the electricity supplier on the market, HS Orka. This approach was adopted because Set did not possess a guarantee of origin for their electricity usage. To represent the impact of HS Orka's geothermal power plants, a life cycle assessment (LCA) of Hellisheiðarvirkjun, a geothermal power plant located in the southwest of Iceland, was used. Additionally, to model the environmental impact of a hydroelectric plant operated by HS Orka, Ecoinvent data on hydropower was used. The table below displays the calculated GWP-GHG impact factor resulting from these energy sources.

Table 1. Manufacturing energy scenario.

Scenario parameter	Value
Set ehf. Selfoss and Reykjavík, Iceland	
Electricity data source	(Ecoinvent, 2023; Karlsdóttir et al., 2015; *Orkuverin*, n.d.)
Electricity CO_2e / kWh	1.66E-02
Electricity mix	Geothermal, 94.9%, hydroelectric 5.14%.
District heating data source	Not applicable
District heating CO_2e / kWh	Not applicable

More information:
More information about the product is available at https://setpipes.eu/

LCA practitioners:
Hafliði Eiríkur Guðmundsson, Ingibjörg Andrea Bergþórsdóttir, Nicolas Marino Proietti
ReSource International
info@resource.is
https://resource.is/en/home/

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

	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	ND	ND	ND	ND	ND	ND	ND	ND	x	x	x	x	x
Geography	EU	EU	EU / IS										IS	IS	(IS)	IS	(IS)
Specific data used													0%	0%	(0%)	0%	(0%)
Variation – products	-34.4% - +1520%												-24.7% - 971%	-24.7% - 971%	(0%)	-24.7% - 971%	(0%)
Variation – sites	0%												0%	0%	(0%)	0%	(0%)

Content information

The table below describes the contents per declared unit (1 meter). The ranges in parentheses describe the range in weight in the product line, per declared unit.

Product components	Weight, kg	Post-consumer material, weight-%	Biogenic material, weight-% and kg C/kg
Steel	2.55 (1.56 – 48.3)	10.9%	0
HDPE	9.33E-01 (7.28E-01 – 9.64)	0	0
PU	4.95E-01 (3.22E-01 – 5.97)	0	0
TOTAL	3.98 (2.63 – 63.9)	7.09%	0
Packaging materials	**Weight, kg**	**Weight-% (versus the product)**	**Weight biogenic carbon, kg C/kg**
Wood	3.48E-01	8.74%	4.31E-01
Plastic caps	1.32E-03	0.0332%	0
Steel wire	7.85E-04	0.0197%	0
TOTAL	3.50E-01	8.79%	4.29E-01

The product does not contain any REACH SVHC substances in amounts greater than 0.1% (1 000 ppm).

Environmental Information

The estimated impact results are only relative statements, which do not indicate the endpoints of the impact categories, exceeding threshold values, safety margins and/or risks.
As this EPD uses balancing-out reporting, biogenic content of packaging leaving the product system in module A5, are included in results for A1-A3.

Potential environmental impact – mandatory indicators according to EN 15804

Results per functional or declared unit															
Indicator	**Unit**	**A1-A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
GWP-fossil	kg CO_2 eq.	11.6	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.50E-02	4.87E-04	0.00	3.24E-03	0.00
GWP-biogenic	kg CO_2 eq.	0	ND	5.50E-01	ND	ND	ND	ND	ND	ND	ND	0.00	0.00	0.00	0.00	0.00
GWP-luluc	kg CO_2 eq.	7.30E-03	ND	ND	ND	ND	ND	ND	ND	ND	ND	3.45E-04	2.60E-07	0.00	9.73E-09	0.00
GWP-total	kg CO_2 eq.	11.6	ND	5.50E-1	ND	ND	ND	ND	ND	ND	ND	1.53E-02	4.87E-04	0.00	3.24E-03	0.00
ODP	kg CFC 11 eq.	3.00E-07	ND	ND	ND	ND	ND	ND	ND	ND	ND	8.16E-10	1.20E-11	0.00	1.38E-12	0.00
AP	mol H^+ eq.	5.17E-02	ND	ND	ND	ND	ND	ND	ND	ND	ND	3.61E-05	2.77E-06	0.00	8.10E-07	0.00
EP-freshwater	kg P eq.	1.66E-03	ND	ND	ND	ND	ND	ND	ND	ND	ND	4.26E-07	3.73E-08	0.00	2.66E-09	0.00
EP-marine	kg N eq.	1.18E-02	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.61E-05	1.10E-06	0.00	5.42E-04	0.00
EP-terrestrial	mol N eq.	1.12E-01	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.32E-04	1.17E-05	0.00	4.05E-06	0.00
POCP	kg NMVOC eq.	3.82E-02	ND	ND	ND	ND	ND	ND	ND	ND	ND	4.07E-05	4.10E-06	0.00	2.19E-06	0.00
ADP-minerals&metals*	kg Sb eq.	8.53E-05	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.90E-08	1.21E-09	0.00	3.10E-11	0.00
ADP-fossil*	MJ	192	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.17E-01	9.14E-03	0.00	1.14E-03	0.00
WDP*	m^3	2.29	ND	ND	ND	ND	ND	ND	ND	ND	ND	8.88E-04	2.38E-04	0.00	2.13E-06	0.00
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.*

Potential environmental impact – additional mandatory and voluntary indicators

Results per functional or declared unit															
Indicator	**Unit**	**A1-A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
GWP-GHG[1]	kg CO_2 eq.	11.6	ND	0.00	ND	ND	ND	ND	ND	ND	ND	1.53E-02	4.87E-04	0.00	3.24E-03	0.00

Use of resources

Results per functional or declared unit																
Indicator	**Unit**	**A1-A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
PERE	MJ	13.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	4.63E-03	2.66E-04	0.00	2.31E-05	0.00
PERM	MJ	0.00	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.00	0.00	0.00	0.00	0.00
PERT	MJ	13.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	4.63E-03	2.66E-04	0.00	2.31E-05	0.00
PENRE	MJ	102	ND	ND	ND	ND	ND	ND	ND	ND	ND	8.64E-01	3.64E-02	0.00	4.53E-03	0.00
PENRM	MJ	80.7	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.00	0.00	0.00	0.00	0.00
PENRT	MJ	183	ND	ND	ND	ND	ND	ND	ND	ND	ND	8.64E-01	3.64E-02	0.00	4.53E-03	0.00
SM	kg	2.82E-01	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.00	0.00	0.00	0.00	0.00
RSF	MJ	0.00	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.00	0.00	0.00	0.00	0.00
NRSF	MJ	0.00	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.00	0.00	0.00	0.00	0.00
FW	m^3	3.13	ND	ND	ND	ND	ND	ND	ND	ND	ND	5.00E-03	1.46E-04	0.00	1.13E-05	0.00
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															

[1] This indicator accounts for all greenhouse gases except biogenic carbon dioxide uptake and emissions and biogenic carbon stored in the product. As such, the indicator is identical to GWP-total except that the CF for biogenic CO_2 is set to zero.

Waste production and output flows

Waste production

Results per functional or declared unit															
Indicator	**Unit**	**A1-A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
Hazardous waste disposed	kg	9.72E-02	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.00	0.00	0.00	0.00	0.00
Non-hazardous waste disposed	kg	6.59E-01	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.00	0.00	0.00	3.98	0.00
Radioactive waste disposed	kg	1.67E-02	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.06E-05	2.46E-06	0.00	1.49E-07	0.00

Output flows

Results per functional or declared unit																
Indicator	**Unit**	**A1-A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
Components for re-use	kg	0.00	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.00	0.00	0.00	0.00	0.00
Material for recycling	kg	3.22E-01	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.00	0.00	0.00	0.00	0.00
Materials for energy recovery	kg	0.00	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.00	0.00	0.00	0.00	0.00
Exported energy, electricity	MJ	0.00	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.00	0.00	0.00	0.00	0.00
Exported energy, thermal	MJ	0.00	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.00	0.00	0.00	0.00	0.00

Additional environmental information

Assumptions underlining scenario in modules C1-C4, end-of-life

End-of-life fate	Amount
Pipes left in ground	3.78 Kg/per declared unit
Pipes collected for landfilling	1.99E-01 Kg/per declared unit
TOTAL	3.98 Kg/per declared unit
Main assumptions on processes towards landfill	
Digging from pipe from ground: Depth	7.00 E-01 meters
Disassembly: Time per cut	2 minutes (likely maximum)
Disassembly: Length per cut	7 meters
Disassembly: Diesel consumption per hour	36.7 litres
Moving pipe onto truck	Assumed to have same environmental impacts and resource use as disassembly
Transportation to landfill: Distance	39.2 Km

Participation in environmental schemes

Set ehf./GmbH is participating in Operation Clean Sweep, which aims to combat waste of plastic granules from manufacturing companies to the environment. When a company signs up for Operation Clean Sweep, it undertakes to set up the company in a way that avoids spillage of granules and to train staff to always prevent, collect, clean, and dispose of spilled plastic. A registration for Operation Clean Sweep also obliges the company to audit its own performance regularly and to encourage partners to also work against zero waste of plastic granules.

References

AB Volvo. (2023). *Fuel Efficiency Guarantee*. Volvo Construction Equipment North America. https://www.volvoce.com/united-states/en-us/services/volvo-services/fuel-efficiency-services/fuel-efficiency-guarantee/

Andreasi Bassi, S., Biganzoli, F., Ferrara, N., Amadei, A., Valente, A., Sala, S., & Ardente, F. (2023). *Updated characterisation and normalisation factors for the Environmental Footprint 3.1 method*. Publications Office of the European Union. https://publications.jrc.ec.europa.eu/repository/bitstream/JRC130796/JRC130796_01.pdf

Background Reference: Norway. (2019, January 7). EIA: U.S. Energy Information Administration: Independent Statistics & Analyzis. https://www.eia.gov/international/content/analysis/countries_long/Norway/background.htm

CEN. (2019). *EN 253—District heating pipes—Bonded single pipe systems for directly buried hot water networks—Factory made pipe assembly of steel service pipe, polyurethane thermal insulation and a casing of polyethylene*. European committee for standardization.

DIN. (2020). *DIN EN 448—District heating pipes—Bonded single pipe systems for directly buried hot water networks—Factory made fitting assemblies of steel service pipes, polyurethane thermal insulation and a casing of polyethylene*. The German Institude for Standardization.

Ecoinvent. (2023). *Ecoinvent* (3.9.1) [Life Cycle Inventory (LCI) database]. https://ecoinvent.org/

Eisler, T. (n.d.). *Energiregnskab i GJ (detaljeret) efter anvendelse og energitype*. Danmarks Statistik. Retrieved 30 June 2022, from https://www.statistikbanken.dk/statbank5a/selectvarval/saveselections.asp

EPD International AB. (2019). *C-PCR-005 Thermal insulation products* (EN 16783:2017). EPD International AB.

EPD International AB. (2023). *PCR 2019:14 Construction products* (Version 1.3.2). EPD International AB.

European Commission - Joint Research Centre - Institute for Environment and Sustainability. (2010). *International Reference Life Cycle Data System (ILCD) Handbook: Framework and requirements for Life Cycle Impact Assessment models and indicators*. Publications Office of the European Union. https://eplca.jrc.ec.europa.eu/uploads/ILCD-Handbook-LCIA-Framework-Requirements-ONLINE-March-2010-ISBN-fin-v1.0-EN.pdf

European Committee for Standardization. (2017). *Thermal insulation products: Product category rules (PCR) for factory made and in-situ formed products for preparing environmental product declarations* (ÍST EN 16783:2017). Staðlaráð Íslands. https://www.stadlar.is/stadlabudin/vara/?ProductName=IST-EN-16783-2017

European Committee for Standardization. (2019). *Sustainability of Construction Works: Environmental Product Declarations: Core Rules for the Product Category of Construction Products*. (ÍST EN 15804:2012+A2:2019). Staðlaráð Íslands. https://www.stadlar.is/stadlabudin/vara/?ProductName=IST-EN-15804-2012-A2-2019-1

European Committee for Standardization. (2021). *Sustainability of Construction Works: Environmental Product Declarations: Core Rules for the Product Category of Construction Products*. (ÍST EN 15804:2012+A2:2019/AC:2021). Staðlaráð Íslands. https://www.stadlar.is/stadlabudin/vara/?ProductName=IST-EN-15804-2012-A2-2019-AC-2021

Frágangur veitulagna. (n.d.). Veitur. Retrieved 20 November 2023, from https://veitur.is/ertu-ad-fara-ad-grafa/fragangur-veitulagna

Fuc, P., Kurczewski, P., Lewandowska, A., Nowak, E., Selech, J., & Ziolkowski, A. (2016). *An environmental life cycle assessment of forklift operation: A well-to-wheel analysis*. The International Journal of Life Cycle Assessment, 21(10), 1438–1451. https://doi.org/10.1007/s11367-016-1104-y

General Programme Instructions for the International EPD® System (Version 4.0). (2021).

G.P. Manufacturas del Acero. (2020). En*vironmental Product Declaration: Steel Tubes: Pickled tubes, Galvanized tubes, and Special tubes from G.P. Manufacturas del Acero*. EPD International AB. https://api.environdec.com/api/v1/EPDLibrary/Files/9f53a7ed-abe4-4dba-8fa0-c6bac6966997/Data

Hafliði Eiríkur Guðmundsson & Ingibjörg Andrea Bergþórsdóttir. (2023). *Scrap metal collection & processing services: Life-cycle assessment background report: Hringrás ehf.* Hringrás.

International Organization for Standardization. (2006). *Environmental Labels and Declarations - Type III Environmental Declarations - Principles and Procedures* (ISO Standard No. 14025:2006). https://www.iso.org/standard/38131.html

International Organization for Standardization. (2006). *Environmental Management – Life Cycle Assessment - Principles and Framework* (ISO Standard No. 14040:2006). https://www.iso.org/standard/37456.html

International Organization for Standardization. (2006). *Environmental Management – Life Cycle Assessment – Requirements and Guidelines* (ISO Standard No. 14044:2006). https://www.iso.org/standard/38498.html

International Organization for Standardization. (2022). *Environmental Labels and Declarations—General Principles* (ISO Standard No. 14020:2022). https://www.iso.org/standard/79479.html

ÍSAGA. (2002). *Logsuða, logskurður, lóðun*. AGA. https://www.linde-gas.is/is/images/Handb%C3%B3k%20-%20Logsuda%2C%20logskurdur%20og%20lodning_tcm648-126196.pdf

Karlsdóttir, M. R., Pálsson, Ó. P., Pálsson, H., & Maya-Drysdale, L. (2015). *Life cycle inventory of a flash geothermal combined heat and power plant located in Iceland*. The International Journal of Life Cycle Assessment, 20(4), 503–519. https://doi.org/10.1007/s11367-014-0842-y

Katz, S., & Lindner, A. S. (2003). *A Life-Cycle Comparison of Several Auxiliary Blowing Agents Used for the Manufacture of Rigid Polyurethane Foam*. Journal of the Air & Waste Management Association, 53(4), 469–477. https://doi.org/10.1080/10473289.2003.10466176

Kuenen, J., & Trozzi, C. (2019). *EMEP/EEA Air Pollutant Emission Inventory Guidebook 2019: Chemical Products*. European Environment Agency. https://www.eea.europa.eu/publications/emep-eea-guidebook-2019

Lumsden, K. (n.d.). *Truck Masses and Dimensions: Impact on Transport Efficiency*. European Automobile Manufacturers Association. https://www.acea.auto/files/SAG_8_Trucks_Masses__Dimensions.pdf

Lundberg, L., Cintas Sanchez, O., & Zetterholm, J. (2023). *The impact of blending mandates on biofuel consumption, production, emission reductions and fuel prices*. Energy Policy, 183, 113835. https://doi.org/10.1016/j.enpol.2023.113835

Marcegaglia Carbon Steel S.p.A. (2023). *Environmental Product Declaration: Profiled Tubes from Hot and Cold Rolled Strip, Heat Treated and Drawn*. EPD International AB. https://api.environdec.com/api/v1/EPDLibrary/Files/2a4a5b62-5214-4e08-951b-08db0f3b9032/Data

Marine Environment Protetction Committee. (2021). *Energy Efficiency of Ships: Report of fuel oil consumption data submitted to the IMO Ship Fuel Oil Consumption Database in GISIS* (Reporting year: 2020). International Maritime Organization. https://wwwcdn.imo.org/localresources/en/OurWork/Environment/Documents/Air%20pollution/MEPC%2077-6-1%20-%202020%20report%20of%20fuel%20oil%20consumption%20data%20submitted%20to%20the%20IMO%20Ship%20Fuel%20Oil%20Consumption%20Database%20in%20GISIS.pdf

Náttúrufræðistofnun Íslands. (2018). *Vistgerðir og mikilvæg fuglasvæði á Íslandi* [Interactive map]. Náttúrufræðistofnun Íslands. https://vistgerdakort.ni.is/

Nitrogen: Density and Specific Weight vs. Temperature and Pressure. (n.d.). The Engineering ToolBox. Retrieved 14 September 2023, from https://www.engineeringtoolbox.com/nitrogen-N2-density-specific-weight-temperature-pressure-d_2039.html

OpenLCA (2.0.1). (2023). [Computer software]. Greendelta. www.openlca.org

Orkuverin. (n.d.). HS Orka. Retrieved 3 February 2023, from https://www.hsorka.is/um-okkur/starfsemi/orkuverin/

Reglugerð um gæði eldsneytis, Pub. L. No. 960 (2016). https://www.reglugerd.is/reglugerdir/eftir-raduneytum/umhverfis--og-audlindaraduneyti/nr/0960-2016

Rentz, O. (1993). *Konzeptionen zur Minderung der VOC-Emissionen in Baden-Württemberg*. Bericht der VOC-Landeskommission (21; Luft-Boden-Abfall). Umweltministerium Baden-Württemberg.

SABIC. (2023). *SABIC® HDPE*. SABIC. https://www.sabic.com/en/products/polymers/polyethylene-pe/sabic-hdpe

Salzgitter Mannesmann Forschung. (2016). *Environmental Product Declaration: MSH Sections*. Institut Bauen und Umwelt e.V. https://www.mannesmann-linepipe.com/fileadmin/footage/MEDIA/gesellschaften/smlp/Documents/EPD-MSH-Sections.pdf

Sea Distance Calculator. (n.d.). ShipTraffic.Net. Retrieved 24 February 2023, from http://www.shiptraffic.net/2001/05/sea-distances-calculator.html

Smyril Line Cargo. (n.d.). MS Mykines: Sailing Schedule. Retrieved 24 February 2022, from https://www.smyrillinecargo.com/Files/Images/smyrilline_2018/Cargo/PDF/2020/Sailing-schedules/Mykines.pdf

Statoil. (2016). *Öryggisblað (SDS): Díselolía* (Gunnar Þórðarson, Trans.). N1. https://www.n1.is/media/20750/diselolia_-215082016.pdf

Winther, M., & Dore, C. (2019). *1.A.4 Non road mobile machinery 2019*. In EMEP/EEA air pollutant emission inventory guidebook 2019. Publications Office of the European Union. https://www.eea.europa.eu/ds_resolveuid/6H3DTV1K4Z

EPD®

www.environdec.com