ENVIRONMENTAL PRODUCT DECLARATION

IN ACCORDANCE WITH EN 15804+A2 & ISO 14025 / ISO 21930

ELGEF PLUS

GEORG FISCHER PIPING SYSTEMS LTD.

EPD HUB, HUB-1550
Publishing on 11.07.2024, last updated on 11.07.2024, valid until 11.07.2029

GENERAL INFORMATION

MANUFACTURER

Manufacturer	Georg Fischer Piping Systems Ltd.
Address	Ebnatstrasse 111, 8201 Schaffhausen/Switzerland
Contact details	sustainability.ps@georgfischer.com
Website	www.gfps.com

EPD STANDARDS, SCOPE AND VERIFICATION

Program operator	EPD Hub, hub@epdhub.com
Reference standard	EN 15804+A2:2019 and ISO 14025
PCR	EPD Hub Core PCR version 1.1, 5 Dec 2023
Sector	Construction product
Category of EPD	Third party verified EPD
Scope of the EPD	Cradle to gate with options, A4-A5, and modules C1-C4, D
EPD author	Niklas Schmidt, Georg Fischer Piping Systems Ltd.
EPD verification	Independent verification of this EPD and data, according to ISO 14025: ☐Internal verification ☒External verification
EPD verifier	Imane Uald lamkaddam, as an authorized verifier acting for EPD Hub Limited

The manufacturer has the sole ownership, liability, and responsibility for the EPD. EPDs within the same product category but from different programs may not be comparable. EPDs of construction products may not be comparable if they do not comply with EN 15804 and if they are not compared in a building context.

PRODUCT

Product name	ELGEF Plus
Additional labels	ELGEF Plus Electrofusion couplers, fittings, saddles, spigot fittings and ball valves.
Product reference	ELGEF Plus coupler, 753911614
Place of production	Schaffhausen, Switzerland
Period for data	2022
Averaging in EPD	Multiple products
Variation in GWP-fossil for A1-A3	-8.24 %

ENVIRONMENTAL DATA SUMMARY

Declared unit	1kg
Declared unit mass	1kg
GWP-fossil, A1-A3 (kgCO2e)	3,53E+00
GWP-total, A1-A3 (kgCO2e)	3,15E+00
Secondary material, inputs (%)	1.77
Secondary material, outputs (%)	3.11
Total energy use, A1-A3 (kWh)	27
Net fresh water use, A1-A3 (m3)	0.3

PRODUCT AND MANUFACTURER

ABOUT THE MANUFACTURER

GF Piping Systems is one of the four divisions within Georg Fischer Corporation and a leading provider of plastic and metal piping systems with a global market presence. The product portfolio includes pipes, fittings, valves and the corresponding automation and jointing technology for industry, building technology as well as water and gas utilities. Georg Fischer Piping Systems proactively incorporates its environmental responsibility into its everyday business activities. Because environmental awareness is understood as one of the company‘s core values, internal structures and processes are geared towards sustainability. In this context, Life Cycle Assessments (LCA) are increasingly used to gain insight into the different life cycle phases of our systems.

PRODUCT DESCRIPTION

ELGEF Plus is a PE-system consisting of electrofusion couplers, fittings, saddles, pressure tapping valves, transition adapters, as well as spigot fittings and ball valves. The products are used in water and gas pipelines and industry applications to ensure leak-tight connections. The ELGEF Plus system offers corrosion resistance, low weight, high chemical resistance, low overall costs, and long service life of the installations. The wide-ranging adaptability of ELGEF Plus products, combined with the flexibility of the system, offers decisive advantages. ELGEF Plus products are not only designed to be user- and installation-friendly, but also absolutely safe and reliable. Fittings and raw materials are subject to several quality tests and inspections.
The representative product for this EPD is the ELGEF Plus coupler, but the EPD also covers the remaining ELGEF Plus products mentioned above, excluding pressure tapping valves and transition adapters that are subject of a separate EPD.

Further information can be found at www.gfps.com.

PRODUCT RAW MATERIAL MAIN COMPOSITION

Raw material category	Amount, mass- %	Material origin
Metals	4	Copper wire, Germany
Minerals	-	-
Fossil materials	96	PE100, Germany
Bio-based materials	-	-

BIOGENIC CARBON CONTENT

Product’s biogenic carbon content at the factory gate

Biogenic carbon content in product, kg C	-
Biogenic carbon content in packaging, kg C	-

FUNCTIONAL UNIT AND SERVICE LIFE

Declared unit	1kg
Mass per declared unit	1kg
Functional unit	-
Reference service life	-

SUBSTANCES, REACH - VERY HIGH CONCERN

The product does not contain any REACH SVHC substances in amounts greater than 0,1 % (1000 ppm).

PRODUCT LIFE-CYCLE

SYSTEM BOUNDARY

This EPD covers the life-cycle modules listed in the following table.

Product stage			Assembly stage		Use stage							End of life stage				Beyond the system boundaries		
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D		
x	x	x	x	x	MND	MND	MND	MND	MND	MND	MND	x	x	x	x	x		
Raw materials	Transport	Manufacturing	Transport	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstr./demol.	Transport	Waste processing	Disposal	Reuse	Recovery	Recycling

Modules not declared = MND. Modules not relevant = MNR.

MANUFACTURING AND PACKAGING (A1-A3)

The environmental impacts considered for the product stage cover the manufacturing of raw materials used in the production as well as packaging materials and other ancillary materials. Also, fuels used by machines, and handling of waste formed in the production processes at the manufacturing facilities are included in this stage. The study also considers the material losses occurring during the manufacturing processes as well as losses during electricity transmission.

In regard to the representative product at hand, the environmental impacts considered for the product stage cover the manufacturing of raw materials, polyethylene and copper, used in the production, as well as packaging materials, cardboard and PE-LD. The study also considers the material losses occurring during the manufacturing processes and the impacts of green hydroelectricity transmission. The ELGEF Plus coupler consists of polyethylene and copper wire.

The components are produced in Europe. The polyethylene couplers are produced by injection molding, whereby the wire is overmolded with polyethylene. Waste polyethylene generated during the production process is to be recycled in module A3, whereas the waste copper wire is to be sorted and pressed.

The packaging used during transport from the supplier to the fabrication site (A2) is part of a multi-use system, like Euro-pallets. Additionally, units of the ELGEF Plus coupler are protected by a PE-LD foil, which must be wrapped around each coupler for application purposes. In order to foster sustainable manufacturing practices and responsible resource management, a share of recycled material is used. The protected couplers are then packed together in cardboard boxes. Not included in A3 are the infrastructure at the production site and the administration activities of the employees.

TRANSPORT AND INSTALLATION (A4-A5)

Transportation impacts occurred from final products delivery to construction site (A4) cover fuel direct exhaust emissions, environmental impacts of fuel production, as well as related infrastructure emissions.

The transportation distances are based on the location to which the item was sold the most and which, therefore, accounts for the majority of transportation. Regarding the ELGEF Plus coupler, the transportation distance is 170km from the plant in Schaffhausen, Switzerland to the Sales Company in Albershausen, Germany. Installation waste treatment and transport to the treatment facility are included in module A5, where 100 km was selected as the average distance. Furthermore, the energy emissions needed for the installation of the ELGEF Plus products are represented in this module.

PRODUCT USE AND MAINTENANCE (B1-B7)

This EPD does not cover the use phase. The product does not emit any substances or consume energy in this phase.
Air, soil, and water impacts during the use phase have not been studied.

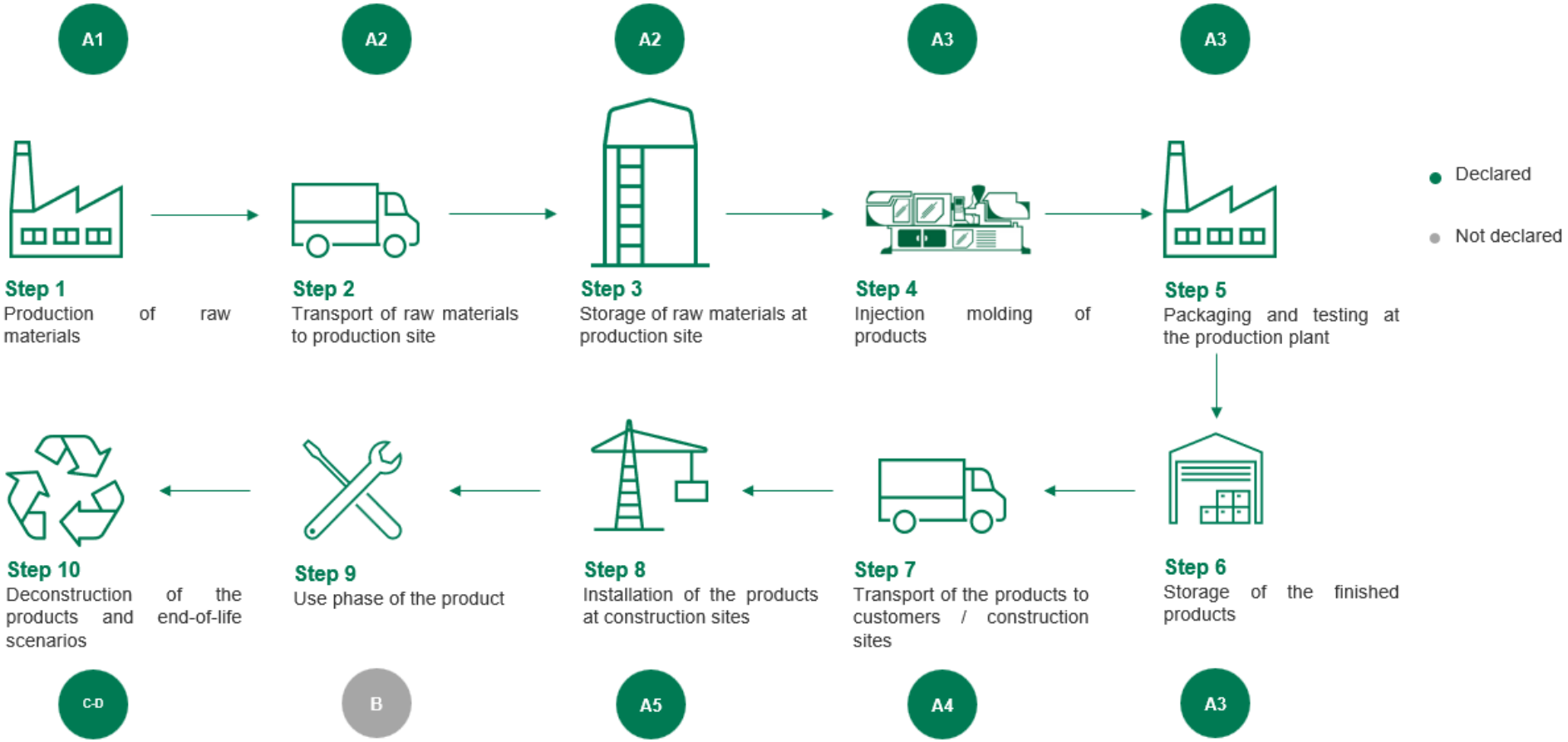
PRODUCT END OF LIFE (C1-C4, D)

The end-of-life stage data for this EPD is based on the following two sources. The proportion of recycled copper wire is based on data from the World Steel Association (WSA), while the proportion of recycled, incinerated, and landfilled plastic is based on data from the European Committee.

Module D covers the benefits and loads of copper and plastic processing as well as packaging waste processing.

At the end of the economic or technical lifetime of the piping system, which is expected to be 100 years for polyethylene, the products are taken out together with the pipes. This means that deconstruction is a side activity of new installations, hence zero resources and energy are consumed during deconstruction stage C1. The products are assumed to be fully separated into their unique materials. Waste processing and disposal have been modelled to reflect average European scenarios. As a conservative assumption, the transport distance to waste processing or disposal is 100 km by truck. 85% of the copper wire is assumed to be recycled, while the other 15% end up in a landfill. Over 40% of the polyethylene is supposed to be incinerated, around 30% is recycled, and the remaining share is sent to landfills.

MANUFACTURING PROCESS



LIFE-CYCLE ASSESSMENT

CUT-OFF CRITERIA

The study does not exclude any modules or processes which are stated mandatory in the reference standard and the applied PCR. The study does not exclude any hazardous materials or substances. The study includes all major raw material and energy consumption. All inputs and outputs of the unit processes, for which data is available for, are included in the calculation. There is no neglected unit process more than 1% of total mass or energy flows. The module specific total neglected input and output flows also do not exceed 5% of energy usage or mass.

ALLOCATION, ESTIMATES AND ASSUMPTIONS

Allocation is required if some material, energy, and waste data cannot be measured separately for the product under investigation. All allocations are done as per the reference standards and the applied PCR. In this study, allocation has been done in the following ways:

Data type	Allocation
Raw materials	No allocation
Packaging materials	No allocation
Ancillary materials	Not applicable
Manufacturing energy and waste	Allocated by mass or volume

AVERAGES AND VARIABILITY

Type of average	Multiple products
Averaging method	Representative product
Variation in GWP-fossil for A1-A3	-8.24 %

This EPD covers the product range of PE100 electrofusion couplers, fittings, saddles, spigot fittings, and PE ball valves. The representative product for this EPD is the ELGEF Plus electrofusion coupler d110. The electrofusion fittings range has 1.98% lower GWP fossil A1-A3 emission. The electrofusion saddle range is 2.83% lower, the spigot fitting range is 8.24% lower, and the PE ball valve has 3.68% lower GWP fossil A1-A3 emission than the coupler as a representative product.

LCA SOFTWARE AND BIBLIOGRAPHY

This EPD has been created using One Click LCA EPD Generator. The LCA and EPD have been prepared according to the reference standards and ISO 14040/14044. The EPD Generator uses Ecoinvent v3.8, Plastics Europe, Federal LCA Commons and One Click LCA databases as sources of environmental data.

ENVIRONMENTAL IMPACT DATA

CORE ENVIRONMENTAL IMPACT INDICATORS – EN 15804+A2, PEF

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
GWP – total[1)]	kg CO_2e	3,10E+00	9,25E-02	-4,49E-02	3,15E+00	3,34E-02	4,58E-01	MND	MND	MND	MND	MND	MND	MND	MNR	9,39E-03	1,27E+00	3,55E-02	-1,80E+00
GWP – fossil	kg CO_2e	3,10E+00	9,24E-02	3,40E-01	3,53E+00	3,33E-02	6,22E-02	MND	MND	MND	MND	MND	MND	MND	MNR	9,38E-03	1,27E+00	3,55E-02	-1,80E+00
GWP – biogenic	kg CO_2e	0,00E+00	1,26E-06	-3,87E-01	-3,87E-01	1,28E-05	3,95E-01	MND	MND	MND	MND	MND	MND	MND	MNR	3,63E-06	2,92E-03	2,11E-05	-4,25E-05
GWP – LULUC	kg CO_2e	2,48E-03	3,75E-05	2,06E-03	4,59E-03	1,36E-05	7,75E-05	MND	MND	MND	MND	MND	MND	MND	MNR	3,46E-06	4,05E-05	2,73E-06	-1,96E-03
Ozone depletion pot.	kg $CFC_{-11}e$	1,70E-07	2,04E-08	2,28E-08	2,14E-07	7,35E-09	2,70E-09	MND	MND	MND	MND	MND	MND	MND	MNR	2,16E-09	2,05E-09	7,88E-10	-7,12E-08
Acidification potential	mol H^+e	2,86E-02	3,83E-04	1,36E-03	3,03E-02	1,38E-04	1,79E-04	MND	MND	MND	MND	MND	MND	MND	MNR	3,97E-05	2,68E-04	2,23E-05	-1,58E-02
EP-freshwater[2)]	kg Pe	1,71E-04	7,79E-07	1,62E-05	1,87E-04	2,81E-07	8,48E-06	MND	MND	MND	MND	MND	MND	MND	MNR	7,68E-08	8,28E-07	4,28E-08	-7,63E-05
EP-marine	kg Ne	2,63E-03	1,12E-04	4,51E-04	3,19E-03	4,03E-05	4,90E-05	MND	MND	MND	MND	MND	MND	MND	MNR	1,18E-05	1,09E-04	1,36E-05	-1,66E-03
EP-terrestrial	mol Ne	3,19E-02	1,23E-03	3,82E-03	3,69E-02	4,44E-04	4,97E-04	MND	MND	MND	MND	MND	MND	MND	MNR	1,30E-04	1,15E-03	8,22E-05	-1,98E-02
POCP ("smog")[3)]	kg NMVOCe	1,20E-02	3,76E-04	1,13E-03	1,35E-02	1,35E-04	1,33E-04	MND	MND	MND	MND	MND	MND	MND	MNR	4,17E-05	3,02E-04	3,14E-05	-6,36E-03
ADP-minerals & metals[4)]	kg Sbe	4,32E-04	3,17E-07	2,20E-06	4,35E-04	1,16E-07	1,68E-07	MND	MND	MND	MND	MND	MND	MND	MNR	2,20E-08	4,41E-07	8,84E-09	-1,30E-04
ADP-fossil resources	MJ	9,07E+01	1,34E+00	6,32E+00	9,84E+01	4,83E-01	8,46E-01	MND	MND	MND	MND	MND	MND	MND	MNR	1,41E-01	2,75E-01	6,04E-02	-3,58E+01
Water use[5)]	m^3e depr.	1,70E+00	5,87E-03	1,07E+01	1,24E+01	2,11E-03	1,57E-02	MND	MND	MND	MND	MND	MND	MND	MNR	6,31E-04	4,13E-02	3,59E-04	-5,00E-01

1) GWP = Global Warming Potential; 2) EP = Eutrophication potential. Required characterisation method and data are in kg P-eq. Multiply by 3,07 to get PO4e; 3) POCP = Photochemical ozone formation; 4) ADP = Abiotic depletion potential; 5) EN 15804+A2 disclaimer for Abiotic depletion and Water use and optional indicators except Particulate matter and Ionizing radiation, human health. The results of these environmental impact indicators shall be used with care as the uncertainties on these results are high or as there is limited experience with the indicator.

USE OF NATURAL RESOURCES

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Renew. PER as energy[8)]	MJ	4,95E+00	1,57E-02	3,56E+01	4,06E+01	5,66E-03	1,16E-01	MND	MND	MND	MND	MND	MND	MND	MNR	1,59E-03	1,95E-02	1,11E-03	-3,18E+00
Renew. PER as material	MJ	0,00E+00	0,00E+00	3,75E+00	3,75E+00	0,00E+00	-3,75E+00	MND	MND	MND	MND	MND	MND	MND	MNR	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Total use of renew. PER	MJ	4,95E+00	1,57E-02	3,93E+01	4,43E+01	5,66E-03	-3,63E+00	MND	MND	MND	MND	MND	MND	MND	MNR	1,59E-03	1,95E-02	1,11E-03	-3,18E+00
Non-re. PER as energy	MJ	4,95E+01	1,34E+00	5,56E+00	5,64E+01	4,83E-01	8,46E-01	MND	MND	MND	MND	MND	MND	MND	MNR	1,41E-01	2,75E-01	6,04E-02	-2,26E+01
Non-re. PER as material	MJ	4,11E+01	0,00E+00	9,88E-01	4,21E+01	0,00E+00	-1,35E+00	MND	MND	MND	MND	MND	MND	MND	MNR	0,00E+00	-3,06E+01	-1,02E+01	1,46E+01
Total use of non-re. PER	MJ	9,07E+01	1,34E+00	6,55E+00	9,86E+01	4,83E-01	-5,08E-01	MND	MND	MND	MND	MND	MND	MND	MNR	1,41E-01	-3,03E+01	-1,01E+01	-8,03E+00
Secondary materials	kg	1,77E-02	4,38E-04	1,30E-01	1,49E-01	1,59E-04	2,32E-04	MND	MND	MND	MND	MND	MND	MND	MNR	3,91E-05	1,16E-03	2,13E-05	-5,18E-03
Renew. secondary fuels	MJ	1,51E-02	5,63E-06	8,46E-02	9,98E-02	2,06E-06	2,16E-06	MND	MND	MND	MND	MND	MND	MND	MNR	3,95E-07	9,61E-06	8,20E-07	-3,58E-05
Non-ren. secondary fuels	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	MND	MND	MND	MND	MND	MND	MNR	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Use of net fresh water	m^3	4,71E-02	1,59E-04	2,51E-01	2,99E-01	5,70E-05	3,86E-04	MND	MND	MND	MND	MND	MND	MND	MNR	1,83E-05	2,26E-04	6,48E-05	-1,93E-02

8) PER = Primary energy resources.

END OF LIFE – WASTE

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Hazardous waste	kg	1,73E-01	1,92E-03	2,97E-02	2,05E-01	6,95E-04	4,46E-03	MND	MND	MND	MND	MND	MND	MND	MNR	1,87E-04	3,10E-03	6,00E-03	-1,31E-01
Non-hazardous waste	kg	9,27E+00	3,07E-02	5,81E-01	9,88E+00	1,11E-02	5,85E-01	MND	MND	MND	MND	MND	MND	MND	MNR	3,07E-03	4,40E-01	2,39E-01	-5,18E+00
Radioactive waste	kg	1,62E-04	8,86E-06	4,21E-05	2,13E-04	3,19E-06	3,35E-06	MND	MND	MND	MND	MND	MND	MND	MNR	9,43E-07	5,30E-07	0,00E+00	-8,00E-05

END OF LIFE – OUTPUT FLOWS

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	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	MND	MND	MND	MND	MND	MND	MND	MNR	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Materials for recycling	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	7,26E-02	MND	MND	MND	MND	MND	MND	MND	MNR	0,00E+00	3,40E-02	0,00E+00	0,00E+00
Materials for energy rec	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	MND	MND	MND	MND	MND	MND	MNR	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Exported energy	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	4,81E-01	MND	MND	MND	MND	MND	MND	MND	MNR	0,00E+00	1,27E+01	0,00E+00	0,00E+00

ENVIRONMENTAL IMPACTS – EN 15804+A1, CML / ISO 21930

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Global Warming Pot.	kg CO_2e	2,98E+00	9,15E-02	3,45E-01	3,42E+00	3,30E-02	7,28E-02	MND	MND	MND	MND	MND	MND	MND	MNR	9,29E-03	1,27E+00	2,88E-02	-1,74E+00
Ozone depletion Pot.	kg CFC-$_{11}$e	1,48E-07	1,62E-08	1,93E-08	1,84E-07	5,83E-09	2,27E-09	MND	MND	MND	MND	MND	MND	MND	MNR	1,71E-09	1,77E-09	6,26E-10	-5,86E-08
Acidification	kg SO_2e	2,46E-02	2,98E-04	1,05E-03	2,60E-02	1,08E-04	1,41E-04	MND	MND	MND	MND	MND	MND	MND	MNR	3,09E-05	1,96E-04	1,69E-05	-1,36E-02
Eutrophication	kg PO_4^3e	8,46E-03	6,84E-05	7,07E-04	9,24E-03	2,47E-05	7,56E-04	MND	MND	MND	MND	MND	MND	MND	MNR	7,03E-06	4,58E-04	1,33E-03	-3,41E-03
POCP (“smog”)	kg C_2H_4e	1,41E-03	1,21E-05	8,69E-05	1,51E-03	4,37E-06	9,55E-06	MND	MND	MND	MND	MND	MND	MND	MNR	1,21E-06	1,21E-05	5,24E-06	-6,66E-04
ADP-elements	kg Sbe	4,32E-04	3,10E-07	2,10E-06	4,35E-04	1,13E-07	1,64E-07	MND	MND	MND	MND	MND	MND	MND	MNR	2,13E-08	4,33E-07	8,54E-09	-1,30E-04
ADP-fossil	MJ	9,07E+01	1,34E+00	6,31E+00	9,83E+01	4,83E-01	8,46E-01	MND	MND	MND	MND	MND	MND	MND	MNR	1,41E-01	2,75E-01	6,04E-02	-3,55E+01

VERIFICATION STATEMENT

VERIFICATION PROCESS FOR THIS EPD

This EPD has been verified in accordance with ISO 14025 by an independent, third-party verifier by reviewing results, documents and compliancy with reference standard, ISO 14025 and ISO 14040/14044, following the process and checklists of the program operator for:

- This Environmental Product Declaration
- The Life-Cycle Assessment used in this EPD
- The digital background data for this EPD

Why does verification transparency matter? Read more online
This EPD has been generated by One Click LCA EPD generator, which has been verified and approved by the EPD Hub.

THIRD-PARTY VERIFICATION STATEMENT

I hereby confirm that, following detailed examination, I have not established any relevant deviations by the studied Environmental Product Declaration (EPD), its LCA and project report, in terms of the data collected and used in the LCA calculations, the way the LCA-based calculations have been carried out, the presentation of environmental data in the EPD, and other additional environmental information, as present with respect to the procedural and methodological requirements in ISO 14025:2010 and reference standard.

I confirm that the company-specific data has been examined as regards plausibility and consistency; the declaration owner is responsible for its factual integrity and legal compliance.

I confirm that I have sufficient knowledge and experience of construction products, this specific product category, the construction industry, relevant standards, and the geographical area of the EPD to carry out this verification.

I confirm my independence in my role as verifier; I have not been involved in the execution of the LCA or in the development of the declaration and have no conflicts of interest regarding this verification.

Imane Uald lamkaddam, as an authorized verifier acting for EPD Hub Limited
11.07.2024

GF Piping Systems

Environmental Product Declaration

Polyethylene system

According to EN 15804+A1

Sea water cooling intake in a power plant

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1. Declaration of general information

1.1 Introduction

GF Piping Systems is one of the three divisions within Georg Fischer Corporation and a leading provider of plastic and metal piping systems with global market presence. The product portfolio includes pipes, fittings, valves and the corresponding automation and jointing technology for industry, building technology as well as water and gas utilities. Georg Fischer Piping Systems proactively incorporates its environmental responsibility into its everyday business activities. Because we understand environmental awareness as one of the corporation's core values, internal structures and processes are geared towards sustainability. In this context, life cycle assessments are the correct tool to gain insight in the different life cycle phases of our systems.

This EPD is based on a detailed background report written by the Flemish Institute for technological research (Vito). The report is in line with EN 15804+A1 "Sustainability of construction works – environmental product declarations – Core rules for the product category of construction products". The data of the study complies with the quality requirements set out in EN 15804+A1
(EN 15804+A1:2013, Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products). Data regarding the production of the pipe system components is company specific and was provided by GF Piping Systems.

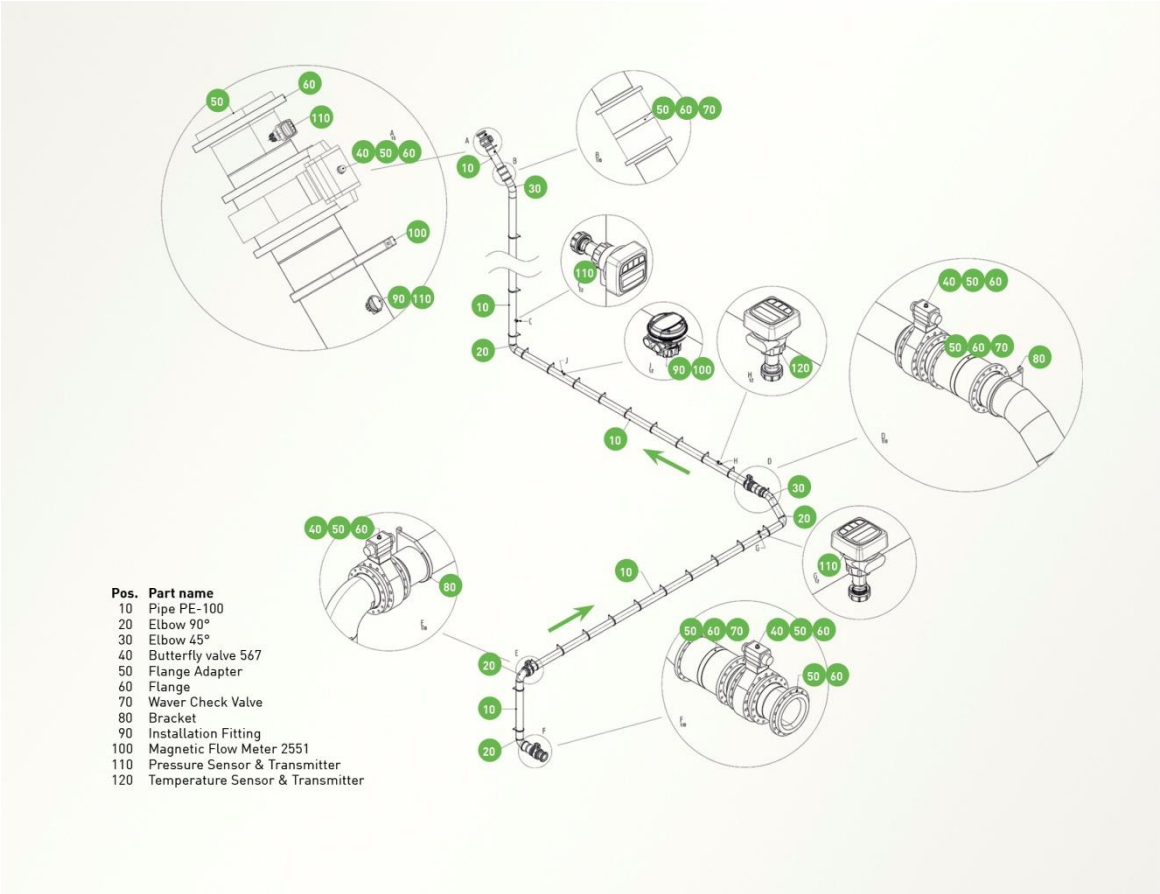
Declaration	
Declaration owner & Program operator's name	Georg Fischer Piping Systems Ltd.
Validity	26.03.2020 – 25.03.2025
Declaration Number	GFPS-EPD_2005-1_5

EPD-Type	Cradle to grave
Data calculated by	Vito NV (Flemish Institute for technological research) www.vito.be
Life Cycle Inventory (LCI) source for generic background processes	Ecoinvent 3.5 Industry data 2.0 database
Software	SimaPro 9.0.0

Certified Management System SQS ISO 9001 / 14001 / OHSAS 18001

1.2 System

The analyzed case represents an exemplary system for the transport of sea water to a power plant where it is used for process cooling. The system is designed in the dimension d400 and installed in Jiaxing (China). The used jointing technology is butt fusion.



Materials

The material of the main pipe system components (pipes and fittings) is PE-100. The whole system consists of the materials as listed below.

Material		Weight (kg)
PE-100		3 802
Plastics (other than PE-100)		316
Steel		154
Other metals		29
Rubber		3
Cable (metal + plastics)		2 + 4
Pump	Iron	499
	Steel	234
Motor	Steel	931
	Iron	455
	Other metals	115
	Paint	8
	Resin	7
	Insulation material	6

Reference service life

25 years

Please refer to chapter 2.3 for further information on the reference service life of the system.

Functional unit (FU)

The above ground transportation of sea water to the cooling facility in a power plant, over a length of 80.2 m and a height difference of 10 m over the whole service lifetime of 25 years. The transport starts at the water surface and ends at the cooling facility.

Components of the system (number of pieces or meter)

The system mainly consists of Georg Fischer Piping Systems components. However, to complete the system also external components (Ext.) are necessary which are not produced by Georg Fischer Piping Systems. The calculation of the environmental impact of these products is based on publicly available data and assumptions.

	Product Code	Pieces or meter	Material
System components			
PE pipe, d400	193017175	80.2 m	PE-100
Bend 90°, d400	753021025	4	PE-100
Bend 45°, d400	753051025	2	PE-100
Flange adapters, d400	753800025	16	PE-100
Installation fittings, d400 – d630	753314002	3	PE-100
Backing flanges, d400	727700525	16	PPGF30
Butterfly valve type 567 (with pneumatic actuator), d400	167567052	4	PP-H (body) and others
Wafer check valve type 369, d400	Custom made item	3	PP-H (body) and others
2551 Magmeter flow sensor	159001112	2	PP (sensor body) and others
Level/pressure integral system	159001041	2	PVDF (sensor housing) and others
2350 Temperature sensor	159000920	1	PVDF (sensor housing) and others
9900 Transmitter	159001696	1	PBT (housing) and others
Cable	Ext.	120 m	Copper and others
Pump	Ext.	1	Various metals and others
Motor	Ext.	1	Various metals and others
Components for installation			
Bolts	Ext.	64	Stainless steel
Nuts	Ext.	128	Stainless steel
Washers	Ext.	128	Stainless steel
Brackets	Ext.	32	PP

1.3 Comparability

EPDs of construction products may not be comparable if they do not comply with the EN 15804+A1.

1.4 Demonstration of verification

CEN standard EN 15804 serves as the core PCR

Independent verification of the declaration and data, according to EN ISO 14025:2010

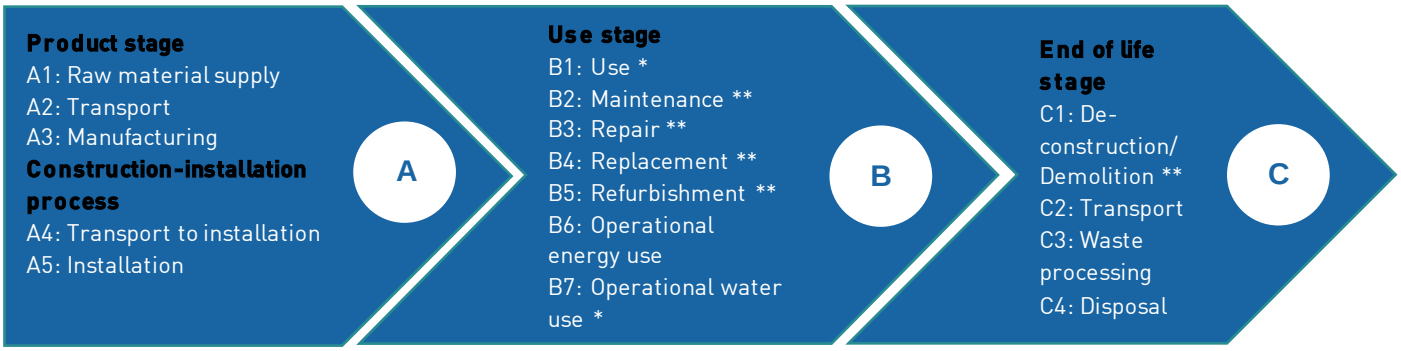
☐ internal ☒ external

Dr. Frank Werner

Company: Dr. Frank Werner Umwelt & Entwicklung, Zürich (Switzerland)

2. Declaration of environmental parameters derived from LCA

2.1 Flow diagram of the processes included in the LCA



* Stage not relevant, ** Environmental impact below cut-off criteria. Please refer to chapter 2.3 for details.

2.2 Parameters describing environmental impacts

	Impact category	Global warming	Ozone depletion	Acidification of soil and water	Eutro-phication	Photo-chemical ozone creation	Abiotic depletion - non fossil	Abiotic depletion - fossil
		kg CO_2 eq	kg CFC-11 eq	kg SO_2 eq	kg PO_4^{3-} eq	kg C_2H_4 eq	kg Sb eq	MJ
A1-3	Product stage	1.84E+04	3.03E-03	1.26E+02	2.41E+01	8.33E+00	3.96E-01	4.09E+05
A4	Transport to installation	6.52E+03	1.20E-03	2.42E+01	4.13E+00	1.04E+00	2.23E-03	9.43E+04
A5	Installation	2.45E+02	4.10E-06	4.50E-01	1.25E-01	5.07E-02	1.16E-04	1.31E+03
B1-5	Use, Maintenance, Repair, Replace-ment, Refurbish-ment	0	0	0	0	0	0	0
B6	Operational energy use	1.03E+07	7.47E-02	4.55E+04	4.70E+03	1.70E+03	2.00E+00	9.13E+07
B7	Operational water use	0	0	0	0	0	0	0
C1	De-construction/ Demolition	0	0	0	0	0	0	0
C2	Transport to end-of-life treatment	3.37E+02	5.49E-05	1.07E+00	1.72E-01	5.74E-02	1.62E-03	4.98E+03
C3	Waste processing	0	0	0	0	0	0	0
C4	Disposal	5.08E+02	1.08E-05	2.35E-01	1.05E-01	8.67E-02	4.93E-05	9.17E+02

2.3 Scenarios and additional technical information

The analyzed case represents an exemplary system for the transport of sea water to a power plant where it is used for process cooling.

Product stage	
A1	The production of the plastic raw material was modeled by generic European data (source: ecoinvent) and complemented by specific data from GF Piping Systems to consider the company specific formulation of the raw material.
A2	Wherever possible, the specific transport distances were taken into account. Data from ecoinvent with the respective parameters was used to model the transportation.
A3	The use of energy is the most important input for this process step. Pipes are extruded while fittings and valve parts are injection moulded. Each of GF Piping Systems' worldwide production sites is certified according to ISO 14001 (Environmental management systems) and to OHSAS 18001 (Occupational health and safety management systems) or is currently in the certification process. For the production of GF Piping Systems components, electricity mixes for the respective country/continent were used. The production of external products was modeled using generic ecoinvent data records for the process.

Construction process	
A4	The system is installed in Jiaxing (near Shanghai), China. Pipes, bends 90° and flange adapters, brackets as well as bolts, nuts and washers are transported over a distance of 127 km by means of a truck directly to the installation site. Measuring instruments are transported by air freight (10 885 km) and truck (127 km) to the installation site. The other components are first transported by truck to storage: Installation fittings (150 km), backing flanges (560 km), bends 45° (130 km), butterfly valves (456 km), check valves (250 km), brackets (700 km). Afterwards they are transported by air (9 262 km) and truck (127 km) to the installation site. For all transportations by truck the ecoinvent data record "Transport, freight, lorry 16-32 metric ton, EURO5 {RER}| transport, freight, lorry 16-32 metric ton, EURO5	Cut-off, U'" was used. Loading capacity is 60%.
A5	For the installation of the whole system 72 kWh welding energy (Chinese electricity mix) is needed. Furthermore, specific cleaner (0.2 kg/FU) is necessary. The cleaner is transported by truck (1 027 km) and air freight (9 262 km) to the installation site. Outputs of the complete installation of the system are PE pipe left over (5 kg/FU) and packaging waste (118 kg/FU) whereof 77% is cardboard. All waste is going to landfill. Transport distance to landfill is assumed to be 200 km. Transport is carried out by truck.

Use stage	
B1	There are no further environmental impacts arising from the use of the system. This stage is considered as not relevant.
B2-B5	The system is designed to be operated without repair, maintenance, replacement or refurbishment during the reference service life. This is subject to the condition that the system is operated according to the specifications given by GF Piping Systems. The lifetime of a valve is mainly influenced by the actuation cycles. The number of actuation cycles the valves are tested for is not reached during the life time of the evaluated system. It is possible that in individual cases components of the valve (e.g. seals) must be replaced. In this case the environmental impact is negligible compared to the impact of the whole system and below the cut-off criteria defined in EN 15804+A1.
B6	The operational energy use of the system is an important stage because of the long reference service life of 25 years. 10 082 200 kWh of energy (ecoinvent dataset: Electricity, medium voltage {CN}| market group for | Cut-off, U) for the pump during the use stage is necessary per functional unit.
B7	No operational water use is necessary for the system. This stage is considered as not relevant.

End of life stage	
C1	A small energy input is needed to cut the pipe into smaller pieces. The environmental impact is negligible compared to the impact of the whole system and below the cut-off criteria defined in EN 15804+A1.
C2	Transportation to the end of life treatment facilities is carried out by truck. Distances to recycling and landfill are 200 km.
C3	All metal parts of the system – in total 2 419 kg - are recycled.
C4	All other parts – in total 4 146 kg - are going to landfill.

Reference service life data

Parameter	Data
Reference service life	25 years
Declared product properties	System components are compliant with relevant international standards, e.g. • EN (European Standards) • ISO (International Organization for Standardization) • BS (British Standard) • ASTM (American Society for Testing and Materials) • JIS (Japan Industrial Standard) Most relevant standards are: ISO 15494 Plastics piping systems for industrial applications - Polybutene (PB), Polyethylene (PE) and Polypropylene (PP) - Specifications for components and the system ISO 16136 Industrial valves - Butterfly valves of thermoplastics materials ISO 16137 Industrial valves - Check valves of thermoplastics materials EN 12201 Plastics piping systems for water supply, and for drainage and sewerage under pressure - Polyethylene (PE)
Design application parameters	PE-100 characteristics / Value / Test standard Operating temperature range / -50 °C to + 60 °C / UV resistant / yes / Density / 0.95 g/cm^3 / EN ISO 1183 - 1 Yield stress at 23 °C / 25 N/mm^2 / EN ISO 527 - 1 Tensile e-modulus at 23 °C / 900 N/mm^2 / EN ISO 527 - 1 Charpy notched impact strength at 23 °C / 83 kJ/m^2 / EN ISO 179 – 1/1eA Charpy notched impact strength at -40 °C / 13 kJ/m^2 / EN ISO 179 – 1/1eA Ball indentation hardness (132 N) / 37 MPa / EN ISO 2039 - 1 Crystallite melting point / 130 °C / DIN 51007 Heat conductivity at 23 °C / 0.38 W/m K / EN 12664 Water absorption at 23 °C / 0.01-0.04% / EN ISO 62 For more information, please refer to the planning fundamentals which are available at: gfps.com › support & services › Planning Assistance › Planning Fundamentals › Industrial Piping Systems
Assumed quality of work	• Constant water supply without interrupting operations • Leakproof system reduces water losses • Flexibility of plastics pipes minimizes the risk of water hammer • No corrosion and no incrustation reduces maintenance to a minimum
Outdoor environment	The system is installed in Jiaxing (near Shanghai) where the following outdoor parameters apply: Average air temperature: 17°C Average water temperature: 17°C Average hours of sunshine/day: 5h
Usage conditions	• SDR 11 • PN 16 • Flow rate 2.5 m/s
Maintenance	The system is designed to be operated without repair, maintenance, replacement or refurbishment. This is subject to the condition that the system is installed and operated according to the specifications given by GF Piping Systems. Please refer also to chapter 2.3.

2.4 Parameters describing resource use

Parameters describing resource use, primary energy		Product stage	Construction process stage		Use stage			End of life			
		Total (of product stage)	Transport	Construction installation process	Use, Maintenance, Repair, Replacement, Refurbishment	Operational energy use	Operational water use	De-construction / Demolition	Transport	Waste processing	Disposal
		A1-3	A4	A5	B1-B5	B6	B7	C1	C2	C3	C4
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ, net calorific value	2.77E+04	5.12E+02	8.29E+01	0	9.13E+06	0	0	6.35E+01	0	3.04E+01
Use of renewable primary energy resources used as raw materials		3.55E+02	0	5.84E-01	0	0	0	0	0	0	0
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)		2.81E+04	5.12E+02	8.35E+01	0	9.13E+06	0	0	6.35E+01	0	3.04E+01
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials		2.64E+05	9.56E+04	1.11E+03	0	9.44E+07	0	0	5.09E+03	0	9.87E+02
Use of non-renewable primary energy resources used as raw materials		1.72E+05	0	2.59E+02	0	0	0	0	0	0	0
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)		4.36E+05	9.56E+04	1.36E+03	0	9.44E+07	0	0	5.09E+03	0	9.87E+02

Parameters describing resource use, secondary materials and fuels, and use of water		Product stage	Construction process stage		Use stage			End of life			
		Total (of product stage)	Transport	Construction installation process	Use , Maintenance, Repair, Replacement, Refurbishment	Operational energy use	Operational water use	De-construction / Demolition	Transport	Waste processing	Disposal
		A1-3	A4	A5	B1-B5	B6	B7	C1	C2	C3	C4
Use of secondary material*	kg	1.37E+03	0	0	0	0	0	0	0	0	0
Use of renewable secondary fuels*	MJ, net calorific value	0	0	0	0	0	0	0	0	0	0
Use of non-renewable secondary fuels*	MJ, net calorific value	0	0	0	0	0	0	0	0	0	0
Net use of fresh water	m^3	2.74E+02	1.11E+01	4.14E-01	0	1.44E+04	0	0	8.08E-01	0	1.14E+00

*Only for foreground process from which LCI data are made available by GF Piping Systems - the number does not include processes and materials modelled by means of background data, e.g. transportation, electricity, ancillary materials, etc.

2.5 Environmental information describing output flows

Other environmental information describing output flows		Product stage	Construction process stage		Use stage			End of life			
		Total (of product stage)	Transport	Construction installation process	Use, Maintenance, Repair, Replacement, Refurbishment	Operational energy use	Operational water use	De-construction / Demolition	Transport	Waste processing	Disposal
		A1-3	A4	A5	B1-B5	B6	B7	C1	C2	C3	C4
Components for re-use*	kg	0	0	0	0	0	0	0	0	0	0
Materials for recycling*	kg	4.15E+01	0	0	0	0	0	0	0	0	2.42E+03
Materials for energy recovery*	kg	0	0	0	0	0	0	0	0	0	0
Exported energy - electricity*	MJ per energy carrier	3.67E-01	0	0	0	0	0	0	0	0	0
Exported energy - thermal energy*	MJ per energy carrier	7.75E-01	0	0	0	0	0	0	0	0	0

*Only for foreground process from which LCI data are made available by GF Piping Systems - the number does not include processes and materials modelled by means of background data, e.g. transportation, electricity, ancillary materials, etc.

Other environmental information describing waste categories		Product stage	Construction process stage		Use stage			End of life			
		Total (of product stage)	Transport	Construction installation process	Use , Maintenance, Repair, Replacement, Refurbishment	Operational energy use	Operational water use	De-construction/ Demolition	Transport	Waste processing	Disposal
		A1-3	A4	A5	B1-B5	B6	B7	C1	C2	C3	C4
Hazardous waste disposed	kg	4.84E-01	3.22E-02	1.55E-03	0	1.58E+02	0	0	4.01E-03	0	4.17E-04
Non-hazardous waste disposed		7.61E+03	4.30E+02	1.36E+02	0	8.87E+05	0	0	1.77E+02	0	4.15E+03
Radioactive waste disposed		4.66E-01	6.81E-01	2.35E-03	0	5.49E+01	0	0	3.34E-02	0	6.57E-03

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