ENVIRONMENTAL PRODUCT DECLARATION

In accordance with ISO 14025 and EN 15804

AquaPlus
25mm PP-R Pipe
From
INTERPLAST S.A.

Programme:	The International EPD® System, www.environdec.com
Programme operator:	EPD International AB
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Scope of the EPD®	Global

EPD®

CONTENTS

ENVIRONMENTAL PRODUCT DECLARATION DETAILS

Programme information	
Programme Operator:	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

PCR Information		
CEN standard EN 15804+A1:2013 serves as the Core Product Category Rules (PCR)		
Product category rules (PCR):	PCR 2012:01, Version 2.32 "Construction Products and Construction Services" UN CPC code 3632 "Tubes, pipes and hoses, and fittings therefore, of plastics"	
PCR review was conducted by:	IVL Swedish Environmental Research Institute, Secretariat of the International EPD System Appointed PCR Moderator Martin Erlandsson IVL Swedish Environmental Research Institute (email: martin.erlandsson@ivl.se)	
Independent third-party verification of the declaration and data, according to ISO 14025:2006: ☐ EPD process certification ☒ EPD verification		
Third party verifier:	greenzero	Dr. Nikolay Minkov **greenzero.me** GmbH (https://www.greenzero.me) Contact: nikolay.minkov@greenzero.me
Approved by:	The International EPD® System	

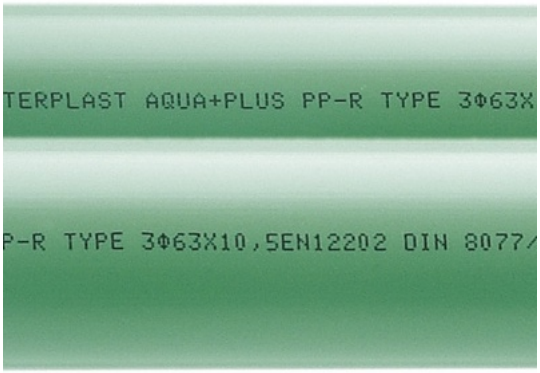
LCA information	
Background LCA Report prepared by:	**LyCIS.HMCS Group** Dr. Giannopoulos Dimitrios Dr. Stamatiadou Marianna Dr. Bonou Alexandra
	LyCIS.HMCS *is s a research group of the* Lab of Heterogeneous Mixtures & Combustion Systems School of Mechanical Engineering National Technical University of Athens (Greece)
Address:	Zografou Campus 9, Iroon Polytechniou str. 15780 Zografou Greece
Contact:	+30 210 772 1218
Website:	www.ntua.gr/hmcs
E-mail:	digiann@central.ntua.gr

Company Information		
Owner of EPD:	**INTERPLAST**	
Contact and location of production site:	*Plastics factory* Industrial area of Komotini, 69100 Komotini, Greece +30 25310.38811-2 +30 25310.38700 +30 25310.98720	*Brass products Factory* Kefalovrisou 23, 13 677 st. Monopati, Acharnai, Athens, Greece +30 210.6209909-10, +30 210.620 44 00
Interplast manufactures plastic pipes and fittings to the very highest specifications, for use in water supply, heating and sewerage systems and covering a broad range of applications in the areas of house construction, technical projects and industrial facilities. The company aims to design, develop and market products and integrated solutions that cover the needs of modern construction and improve quality of life, by building a relationship of trust between the technical world and the consumer public.		
Product-related or management system-related certifications:	• TUV Germany for the Quality Management System EN ISO 9001: 2008. • EVETAM Greece for the physical and mechanical properties of pipes PE-X, PP-H, PVC and PP-R. It involves sizing of pipes and fittings, measuring the degree of networking for PEX pipes, microscopic homogenisation check, impact tests, testing under pressure at various temperatures and checking linear expansion. • SKZ Germany for physical and mechanical properties of pipes PE-X, PE-MDX, PE-RT, PB, PP- H and PP-R. Moreover, sewer pipes PP-H feature fireproofing certificate. It involves sizing of pipes and fittings, measuring the degree of networking for PEX pipes, microscopic homogenisation check, impact tests, testing under pressure at various temperatures and checking linear expansion. • SKZ Germany for physical and mechanical properties of PP-R accessories. • AENOR Spain for physical and mechanical properties of PEX pipes and PPR. • CSA Canada for physical and mechanical properties of pipes PE-X, as for the suitability for drinking water. • GOST Russia for physical and mechanical properties of pipes PE-X, PP-R, PP-R with aluminum and brass fittings, and for suitability for drinking water • SEPRO Ukraine the physical and mechanical properties of pipes PE-X, PP-R, PP-R with aluminum, PP-H and brass components. • ZIK Croatia the physical and mechanical properties of pipes PE-X, PP-R, PP-R aluminum, as for the suitability for drinking water. • MPA-NRW Germany for oxygen permeability of Como-Pex pipes and Como-Floor Oxygen Barrie • WRAS-NSF Great Britain for suitability of pipes PE, PEX and PP-R in drinking water	

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

PRODUCT INFORMATION

Product Name and Description

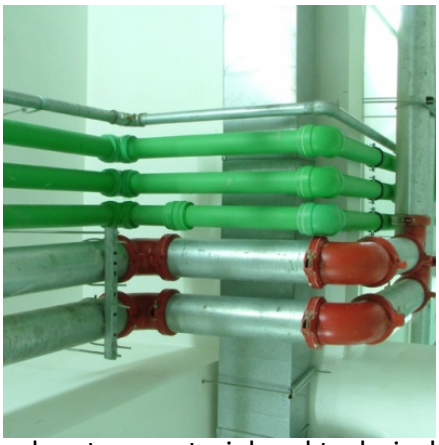


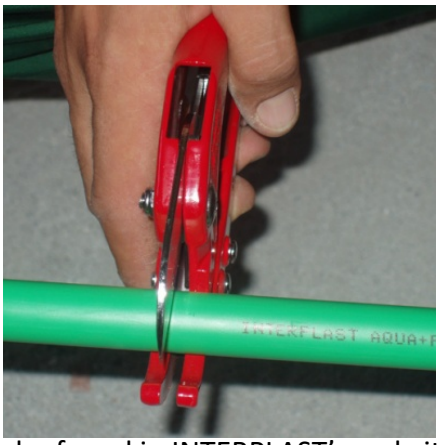
The INTERPLAST product declared in this EPD is the AquaPlus PP-R pipe, 25mm outer diameter, which is utilized for hot and cold potable water.
The structure of the material and the smooth texture of the surface ensure low friction losses resulting in low resistance and low pressure drop in the piping. The material used presents a greatly reduced noise factor and restricted transmission of noise through the pipes. Thus, plastic pipes of smaller cross-section can be used for the same quantity of water.

Advantages of AquaPlus pipe

- Pipes and fittings display high resistance to hydraulic shock (at pressures greater than 130 bar at ambient temperature).
- Lifespan of more than 50 years for temperatures of 20-90°C and operating pressure 6-26 bar.
- Peak temperatures of 110°C at 4 bar operating pressure do not affect the Aqua-plus system.
- Exceptional resistance to corrosion. Very good performance even in areas with very hard water.
- Low thermal conductivity makes it possible to reduce heat loss in the hot water networks.

Certifications: SKZ Germany, WRAS Great Britain, MIRTEC EBETAM
Tests: MIRTEC EBETAM, WRAS NSF, General Chemical State Laboratory





More explanatory material and technical information can be found in INTERPLAST's website (https://www.interplast.gr/en)

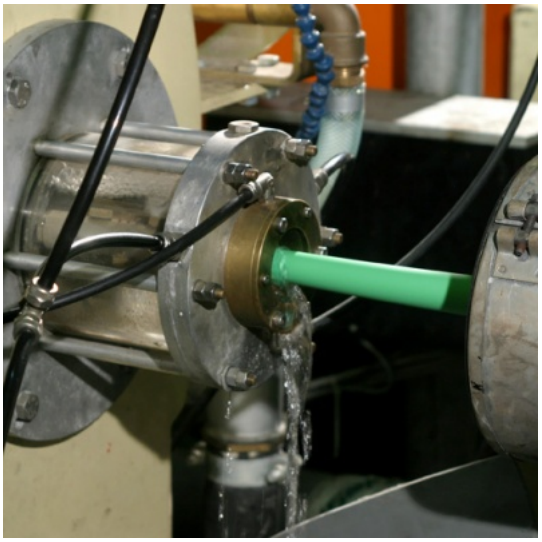
LCA INFORMATION

This EPD outlines the various environmental aspects which accompany the Polypropylene – Random copolymer (PP-R) pipe of INTERPLAST for hot and cold water, from the primary extraction of raw materials up to the manufacturing and packaging of the final product. Due to the scope of the LCA (cradle- to-gate), reference service life is not applicable in the study. However, the minimum guaranteed service life of the pipe is 50 years. Depending on the application, these products can be part of a building or installation without needing any kind of maintenance or replacement.

Declared Unit

With a cradle-to-gate system boundary, a declared unit is considered. According to the PCR, the required declared unit is one piece of pipe with a defined diameter and length. The declared unit being evaluated, in accordance to the guiding PCR is:

1 meter of pipe
with a 25mm outer diameter



The reference flow of the declared unit is 0.226kg of the pipe (no fittings included). Please note that EPDs of construction products may not be comparable if they do not comply with the CEN TC 350 (EN15804 and EN15942) standards.

Database and LCA software used

The LCA model was created using the **SimaPro 9.1** Software system for life cycle engineering, developed by PRé Sustainability. The **EcoInvent** database (v3.6) provides the life cycle inventory data for all the raw and process materials obtained from the background system. This LCA database was compiled in December 2019, while the date of all background data used lies between 2013 and 2019.

System Boundaries

Boundary for the LCA has been set accordingly to the PCR requirements, in a **cradle-to-gate** approach, thus only Modules A1-A3 have been considered. According to the EN 15804+A1:2013 standard on the sustainability of construction works, these modules are: Raw Material Production, inbound Transport, and Manufacturing, which are categorized as A1, A2, and A3, respectively. Transport to the construction site and impacts from installation, use, and end-of-life are excluded due to lack of available data and wide variation in these phases globally. Thus, life cycle modules A4 and after are excluded from the study. The product does not contain materials or substances that can adversely affect human health and the environment in all stages of the life cycle.

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
A1	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
X	X	X	MNA*		MNA							MNA				MNA

(*) MNA: Module(s) Not Assessed

A1. Raw materials Production

This first module includes the extraction and production of all raw matters required for the manufacturing process, as well as the energy consumption involved on those stages upstream the manufacturing process. Specifically, it includes the production of the polypropylene granulate, main raw matter used in the production of the pipes, as well as other additives used in small quantities.

A2. Transport

Transport of raw materials to INTERPLAST's production site has been modelled under this module, taking into account the location of the suppliers and average transportation units from EcoInvent database. Transportation for raw and packaging materials takes place by road and ship.

A3. Manufacturing

This module includes the manufacturing of the pipes. It includes all stages of pipe manufacturing; compound production, pipe extrusion and packaging for further shipping to customers. Electricity and auxiliary materials involved in the manufacturing stage are also included.

Time & Geographical coverage and Data Quality

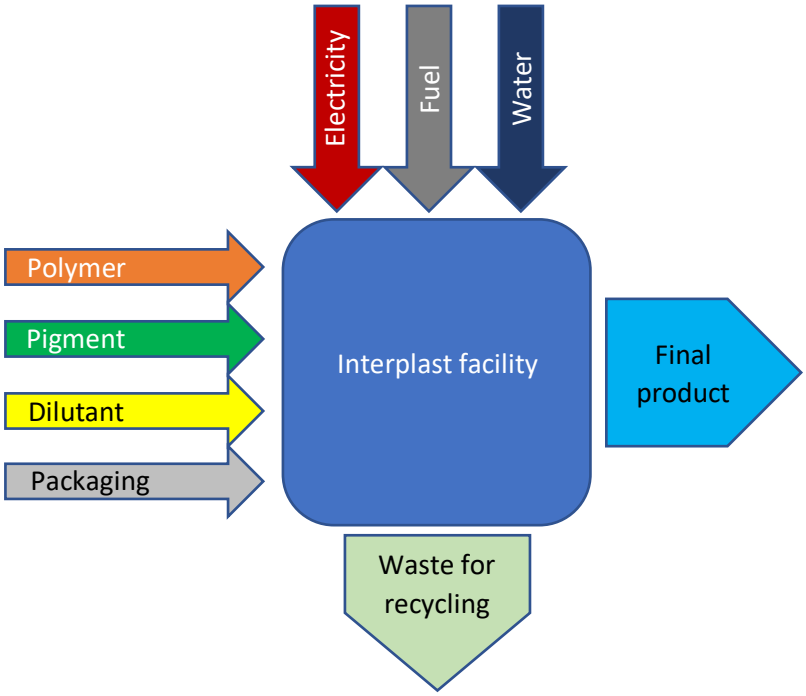
Annual data from 2020 were collected for the pipe manufacturing facilities in Komotini, Greece, and used in LCA calculation. Background data (mainly raw materials, chemicals and fuels) were obtained from the SimaPro database, while the electricity data were collected by the Hellenic Electricity Distribution Network Operator (IPTO or ADMIE) for 2020.

The data represent the technology used at the pipe manufacturing plant. The INTERPLAST data used, refers to the production line of the specific product, thus there is no need for multi-output allocation estimations. In this study, site-specific data representative of the technology used in Greece in the reference year 2020 were collected and analysed. In cases when no primary data were available, either estimations provided by the company or calculated data were used.

Cut-off criteria

All available energy and material flow data have been included in the LCA model which supports this EPD. An exception to that was necessary in the case of the UV-stabilizers included in the pigment used. Since the mass contribution of the UV-stabilizers was minimal (0.3%) and no proxy dataset could be determined, it was decided not to include this material in the study. Another aspect not considered were the emissions related to transporting the waste PP to the recycling facility.

System Diagram



Content Declaration

The INTERPLAST PP-R pipe is exclusively comprised of polypropylene random copolymer (PP-R). No other polymers, accessory metals, additives, or reinforcements are included in this specific product. No hazardous substances or listed under ECHA's SVHC list (Substances of Very High Concern) are included in the formulation of the product. The table below shows the material composition by mass percentage of the product.

Material	25mm PP-R Pipe (1m)
Polypropylene (Virgin PP-R Granules)	100% (0.226kg)

At the INTERPLAST facility, raw material is extruded for the pipe and then packaged for the shipment to the customer. Following table shows the total materials inputs required to meet the declared unit of 1m of 25mm pipe. Plastic scrap was assumed to be sold to external recyclers. Recycling has been considered by system expansion to model the displacement of primary plastic production.

Unit process of PP-R pipe (1m length and 25mm pipe diameter)

Type	Flow	Value	Unit
Inputs	Pigments (Chrome green)	0.0046	kg
	Dilutants (Ethyl Acetate)	0.00001	kg
	Packaging (Plastic Film)	0.005	kg
	PP-R Granules	0.236	kg
Outputs	Final Product (Pipe + Packaging)	0.231	kg
	Plastic Scrap for recycling	0.01	kg

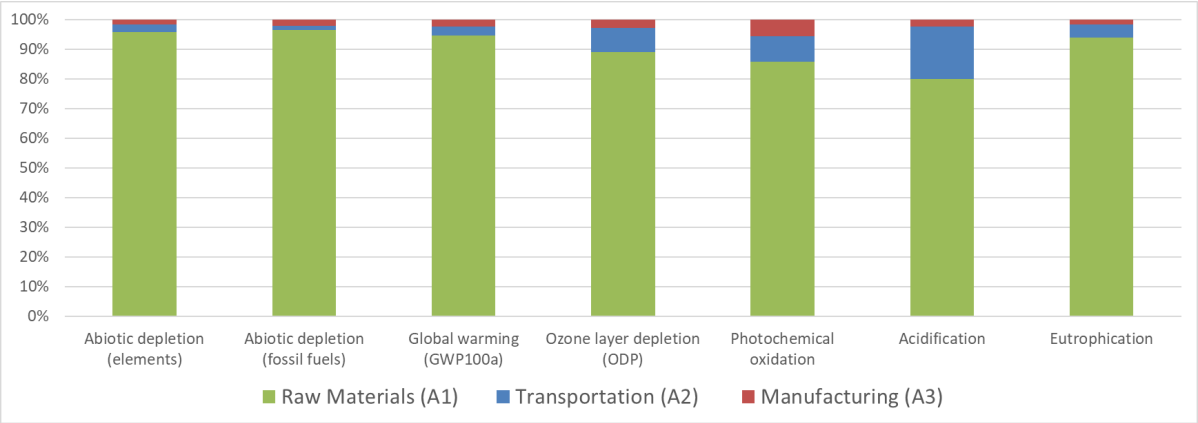
ENVIRONMENTAL PERFORMANCE

The environmental performance of the INTERPLAST PP-R AquaPlus Pipe will be examined for each one of the three modules mentioned before and the impact assessment categories, which are shown in the following table. The selection of impact categories conforms with the relevant PCR specifications. As also dictated by the PCR, the corresponding characterization factors used refer to the latest version of the impact assessment method adopted by EN15804+A1:2013, which is the CML-IA baseline version 3.06 (December 2019).

Impact Category	Description	EN15804+A1:2013
Global Warming (GWP_{100})	A measure of greenhouse gas emissions, such as CO2 and methane.	kg CO2 equivalent
Eutrophication	Eutrophication covers all potential impacts of excessively high levels of macronutrients, the most important of which nitrogen (N) and phosphorus (P).	kg $(PO_4)^{-3}$ equivalent
Acidification for soil and water	A measure of emissions that cause acidifying effects to the environment.	kg SO_2 equivalent
Photochemical Ozone Creation	A measure of emissions of precursors that contribute to ground level smog formation (mainly ozone O3).	kg C_2H_4 equivalent
Ozone Depletion	A measure of air emissions that contribute to the depletion of the stratospheric ozone layer.	kg CFC-11 equivalent
Depletion of abiotic resources – elements	A measure of the depletion of nonliving (abiotic) resources such as minerals and metals	kg Sb equivalent
Depletion of abiotic resources – fossil fuels	A measure of the depletion of nonliving (abiotic) resources such as fossil fuels	MJ

LCA Results

The overall cradle-to-gate results are presented broadly into three categories: Raw Material, Transport, and Manufacturing. For overall results using the EN 15804+A1:2013 life cycle modules as required by the guiding PCR, refer to the declared results in the EPD. The impacts shown and discussed in this report are for analytical purposes only.



Impact contribution of life cycle stages of construction products according to EN 15804+A1:2013 standard

The absolute equivalent values of impacts are summarized in Table below.

Impact Assessment results of INTERPLAST PP-R Pipe (in kg per declared unit of 1m of pipe)

Type	Unit	Total	Raw Material (A1)	Transport (A2)	Manufacturing (A3)
Global Warming (GWP_{100})	kg CO_2 eq	0.664	0.628	0.0201	0.0157
Eutrophication	kg $(PO_4)^{-3}$ eq	1.22E-03	1.14E-03	5.27E-05	2.14E-05
Acidification for soil and water	kg SO_2 eq	2.62E-03	2.10E-03	4.59E-04	6.42E-05
Photochemical Ozone Creation	kg C_2H_4 eq	1.42E-04	1.22E-04	1.21E-05	8.03E-06
Ozone Depletion	kg CFC-11 eq	3.99E-08	3.55E-08	3.29E-09	1.13E-09
Depletion of abiotic resources – elements	kg Sb eq	9.81E-06	9.40E-06	2.44E-07	1.73E-07
Depletion of abiotic resources – fossil fuels	MJ	18.8	18.2	0.263	0.407

Resource use and waste to disposal parameters of INTERPLAST PP-R Pipe (in kg per declared unit of 1m of pipe)

Parameter		Unit	Total	Raw Material (A1)	Transport (A2)	Manufacturing (A3)
Primary energy resources – Renewable	**Use as energy carrier**	MJ, net calorific value	0.724	0.702	0.00227	0.0200
	Used as raw materials	MJ, net calorific value	0	0	0	0
	TOTAL	MJ, net calorific value	0.724	0.702	0.0022	0.0200
Primary energy resources – Non-renewable	**Use as energy carrier**	MJ, net calorific value	21.4	20.7	0.282	0.471
	Used as raw materials	MJ, net calorific value	0	0	0	0
	TOTAL	MJ, net calorific value	21.4	20.7	0.282	0.471
Secondary material		kg	0	0	0	0
Renewable secondary fuels		MJ, net calorific value	0	0	0	0
Non-renewable secondary fuels		MJ, net calorific value	0	0	0	0
Net use of fresh water		m^3	0.00502	0.00215	2.63E-05	0.00284

Hazardous waste disposed	kg	0	0	0	0
Non hazardous waste disposed	kg	0	0	0	0
Radioactive waste disposed	kg	0	0	0	0

Components for re use	kg	0	0	0	0
Materials for recycling	kg	0.0100	0	0	0.0100
Materials for energy recovery	kg	0	0	0	0
Exported energy	MJ per energy carrier	0	0	0	0

Interpretation of LCA Results

The manufacturing process was examined showed minimum wastes, while having no fuel requirements for the core process (pipe extrusion). This study identifies the main drivers of impact for Interplast; significant contributors are analyzed at the cradle-to-gate level as well as at the individual material input level. It was found that the impact contribution of raw materials dominates the cradle-to-gate results. Inbound transportation had a notable impact in some cases. The manufacturing stage had only minor contributions. The present EPD will facilitate the identification of key opportunities for improving manufacturing of all Interplast products.

REFERENCES

General Programme Instructions of the International EPD® System. Version 3.01.

PCR Construction Products and Construction Services (2012:01), version 2.32

EN 15804+A1:2013: Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products.

EN ISO 14040: Environmental Management-Life Cycle Assessment-Principles and framework.

EN ISO 14044: Environmental Management-Life Cycle Assessment-Requirements and guidelines.

EN ISO 14025: Environmental labels and declarations-Type III Environmental Declarations Principles and procedures

JRC. (2010). ILCD Handbook: General guide for Life Cycle Assessment – Detailed guidance. EUR 24708 EN (1st ed.). Luxembourg: Joint Research Centre.

IPTO (ADMIE) S.A. (Hellenic Independent Power Transmission Operator S.A.) http://www.admie.gr/en/market-statistics/montlhy-energy-balance/

www.interplast.gr

Plastic factory

Industrial area of Komotini,
69100 Komotini, Greece

+30 25310.38811-2
+30 25310.38700
+30 25310.98720

+30 25310.38813

+30 6974 060 002

Brass products Factory

Kefalovrisou 23,
13 677 st. Monopati,
Acharnai, Athens, Greece

+30 210.6209909-10,
+30 210.620 44 00

+30 210.6250351,
+30 210.6250745

+30 6978 339 384