bre

Statement of Verification

BREG EN EPD No.: 000475 Issue 01

This is to verify that the

Environmental Product Declaration

provided by:

Aquatherm, GmbH

BRE Global Verified EPD

is in accordance with the requirements of:

EN 15804:2012+A2:2019

and

BRE Global Scheme Document SD207

This declaration is for:

1m of blue / green pipe S / MF / MF-RP Piping system

Company Address

Aquatherm, GmbH
Biggen 5,
57439 Attendorn,
Germany

aquatherm®

Signed for BRE Global Ltd	Emma Baker Operator	10 February 2023 Date of this Issue
10 February 2023 Date of First Issue		09 February 2028 Expiry Date

BRE Global Verified EPD

ECO PLATFORM EPD VERIFIED

Environmental Product Declaration

EPD Number: 000475

General Information

EPD Programme Operator	Applicable Product Category Rules
BRE Global Watford, Herts WD25 9XX United Kingdom	BRE Environmental Profiles 2013 Product Category Rules for Type III environmental product declaration of construction products to EN 15804+A2 PN 514 Rev 3.0

Commissioner of LCA study	LCA consultant/Tool
Aquatherm, GmbH Biggen 5, 57439 Attendorn, Germany	Sphera Solutions - GaBi Innovation Centre Warwick Technology Park Gallows Hill, Heathcote CV34 6UW

Declared Unit	Applicability/Coverage
1m of piping system	Product Average.

EPD Type	Background database
Cradle to Gate, with A5 & Module C1-4 and D	GaBi Software System and Database for Life Cycle Engineering 1992-2022 © Sphera Solutions GmbH

Demonstration of Verification

RIGID AND FLEXIBLE BUILDING PIPING SYSTEMS IN NORTH AMERICA (PCR-1002)[a] in combination with the general program rules of BRE.

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

☐Internal ☒ External

(Where appropriate [b])Third party verifier:
Nigel Jones

a: Product category rules
b: Optional for business-to-business communication; mandatory for business-to-consumer communication (see EN ISO 14025:2010, 9.4)

Comparability

Environmental product declarations from different programmes may not be comparable if not compliant with EN 15804:2012+A2:2019. Comparability is further dependent on the specific product category rules, system boundaries and allocations, and background data sources. See Clause 5.3 of EN 15804:2012+A2:2019 for further guidance

Information modules covered

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

Note: Ticks indicate the Information Modules declared.

Manufacturing sites

Attendorn
Biggen 5,
57439 Attendorn,
Germany

Radeberg
Wilhelm-Rönsch-Strasse,
4 01454 Radeberg,
Germany

Construction Product

Product Description

Aquatherm blue / green pipe S / MF / MF-RP

Aquatherm blue pipe made of corrosion-resistant polypropylene (PP-R & PP-RCT) is a specialist for the transport of cooling and heating media in closed systems and is therefore particularly suitable for various industrial applications. The physical properties of the plastic are adapted to the special requirements of the heating and cooling sector. It is characterized by its high temperature and pressure resistance. Added to this are the exceptionally good welding properties and the fusion into a homogeneous and materially cohesive unit, so that a maximum of safety and service life is achieved. The system contains – in combination with the Aquatherm green pipe fittings – all components for the pipe installation of air conditioning and heating systems as well as for the plant engineering.

Aquatherm green pipe has revolutionized the plastic piping sector and has been shaping it for decades. The innovative all-rounder made of corrosion-resistant polypropylene shows its advantages due to its excellent ecological properties, especially in the field of drinking water applications, because it is completely free of heavy metals and toxic chemicals. Aquatherm green pipe is also suitable for swimming pools, agriculture, shipbuilding or the transport of chemicals considering the chemical resistance. Thanks to the very good welding properties, a form-fit and material-fit and thus secure connection is created.

Product characteristics:

Blue pipe
- High environmental compatibility
- Free of heavy metals
- Extremely corrosion-resistant
- High stability
- Easy to process
- Air conditioning and heating systems

Green pipe
- Extremely corrosion resistant
- Suitable for drinking water
- High environmental compatibility
- Thermal/sound insulation properties
- High stability
- Simple processing
- Drinking water applications

Technical Information

Property	Value, Unit
Density of the Piping system's material (PP-R / PP-RCT)	0,9 g/cm^3
Pipe colour/s	Green, Blue
Weight per meter of average product	0.411 kg/m
Pipe profile diameters	32mm

The results of this EPD refer to an average product of pipe diameter of 32mm and product weight 0.411 kg/m. Information on the full product range (0,111 kg/m - 68,044 kg/m & 20mm to 630mm) can be found in Annex 1.

EPD 1 declares an average product. The average product represents PP-pipes with the same pipe diameter and with the same amount of PP (approx. 90%). Due to the comparability of the material composition between the products the mean value of the green and blue pipes was used.

Main Product Contents

Material Input	%
Polypropylene-R Granulate / Polypropylene-RCT Granulate	92.1%
Brass inserts for transition fittings	4.2%
Reinforcement	2.9%
Pigments	0.8%

Material: fusiolen® PP-R and fusiolen® PP-RCT (polypropylene random copolymer) properties are:

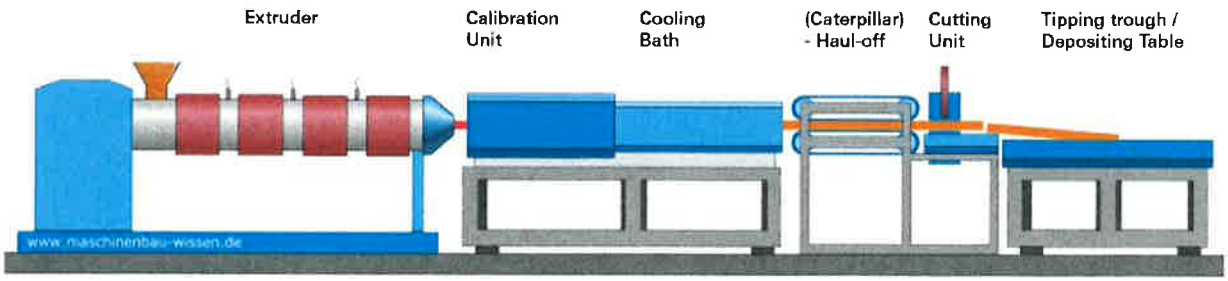
- Combination of carbon and hydrogen
- Polymerized from propene
- Thermoplastic polymer: meltable many a time / weldable
- Suitable for: extrusion process / injection moulding
- Fully recyclable and therefore a valuable raw material
- Contains colours, stabilisers, antioxidants
- Is: long lasting, free of heavy metals, heat stabilised

Manufacturing Process

Pipe production / Extrusion:

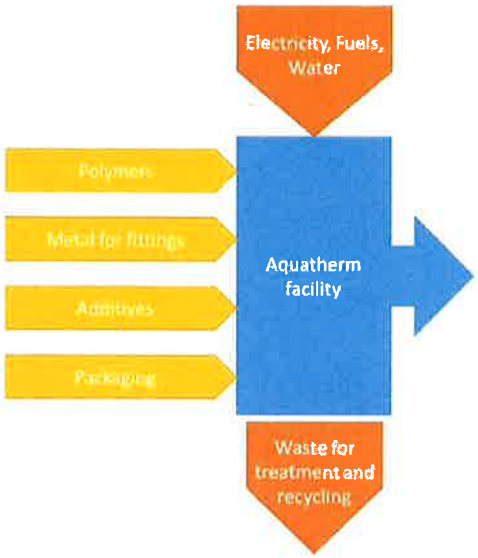
Plastic granulates are continuously melted and pressed through a shaping opening. The ejected semi-finished parts (pipe, profiles, plates, foils) are cooled down immediately after leaving the tool.
The single production steps are as following described:

1. Feeding the granulates to the extruder.
2. Melting of the material while moving it forward with the lead screw.
3. Extrude via jet.
4. Enforcing and cooling.
5. Cutting to the requested length.



Process flow diagram

The following diagram shows the input flows for the production of the pipes:



Construction Installation

Module A5 Installation has been partially included within the system boundaries of this study. The only impacts considered within module A5 is the end of life of packaging used to package Aquatherm products.

End of Life

Modules C1 – C4 have been included within the system boundaries of this study in accordance with EN 15804 +A2. The EoL scenarios considered within module C3 are 100% recycling of brass fittings and 100% incineration of the remaining piping system.

Life Cycle Assessment Calculation Rules

Declared unit description

The declared unit being evaluated, in accordance with the guiding PCR is: "1 meter of piping system."

System boundary

The scope of this EPD is "cradle to gate + Module C and D with options (module A5)." It follows the module approach required by EN 15804+A2. Transport to the construction site and impacts from installation and use B1 – B7 were excluded from the study. However, processing of packaging is included in module A5. This EPD also includes modules C and D under the requirements of the revised EN 15804+ A2 standard.

Data sources, quality and allocation

Data for the manufacture of Aquatherm piping systems has been collected by the client. For the data collection a specifically prepared questionnaire by Sphera has been used. The collection of the foreground data refers to the year 2019 (annual average production). Plant-level data is allocated to the declared product based on yearly produced mass. The data acquisition was done by the client considering the following data sources: Measurements of technical machines/equipment and material consumption.
The EPD uses background data from the GaBi database, 2021, v2, and EPD data for the specific primary input material used. The quality of the data used for the EPD is quantified in terms of its temporal, geographical and technological representativeness in accordance with EN 15804:2012+A2:2019. The data quality of this EPD has been determined as being "good".

Background data incl. allocations are documented at http://database-documentation.gabi-software.com/support/gabi/.).There is no allocation key within the GaBi model.

Cut-off criteria

In the assessment, all available data from the production process are considered, i.e all raw materials used, utilized thermal energy, and electric power consumption using best available LCI datasets. For validity for this LCA, the cut-off criteria for material and energy flows are 1% of the consumption of renewable and non-renewable primary energy and 1% of the total mass input of the respective process unit. The sum of the excluded material flows does not exceed 5% of mass, energy or environmental relevance. Machinery, plants and infrastructure required in the manufacturing process were not considered. With acknowledgement of the above exclusions, this EPD complies with the PCR requirements related to the exclusion of inputs and outputs.

LCA Results

Parameters describing environmental impacts

			GWP-total kg CO_2 eq	GWP-fossil kg CO_2 eq	GWP-biogenic kg CO_2 eq	GWP-luluc kg CO_2 eq	ODP kg CFC11 eq	AP mol H^+ eq	EP-freshwater kg $(PO_4)^{3-}$ eq
Product stage	Raw material supply	A1	9.42E-01	9.36E-01	5.90E-03	4.73E-04	4.99E-15	1.56E-03	1.05E-06
	Transport	A2	2.45E-02	2.43E-02	7.12E-05	1.91E-04	4.71E-18	5.85E-05	6.96E-08
	Manufacturing	A3	2.73E-02	3.39E-02	-6.64E-03	5.33E-05	9.87E-16	7.40E-05	6.76E-06
	Total (of product stage)	A1-3	9.94E-01	9.94E-01	-6.69E-04	7.17E-04	5.98E-15	1.69E-03	7.88E-06
Construction process stage	Construction	A5	3.47E-03	1.86E-04	3.28E-03	2.11E-07	2.57E-18	9.00E-07	7.03E-09
100% incineration scenario for plastic pipe & 100% recycling scenario for brass fittings									
End of life	Deconstruction, demolition	C1	5.95E-03	5.86E-03	7.20E-05	1.49E-05	2.00E-16	8.40E-06	2.45E-08
	Transport	C2	2.43E-03	2.40E-03	7.19E-06	1.96E-05	4.74E-19	2.55E-06	7.13E-09
	Waste processing	C3	1.14E+00	1.14E+00	4.08E-05	7.64E-06	9.19E-17	1.17E-04	1.57E-08
	Disposal	C4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-8.07E-01	-8.06E-01	-8.69E-04	-1.43E-04	-1.02E-15	-9.16E-04	-8.84E-08

GWP-total = Global warming potential, total;
GWP-fossil = Global warming potential, fossil;
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; and
EP-freshwater = Eutrophication potential, fraction of nutrients reaching freshwater end compartment

LCA Results (continued)

Parameters describing environmental impacts

			EP-marine	EP-terrestrial	POCP	ADP-mineral& metals	ADP-fossil	WDP	PM
			kg N eq	mol N eq	kg NMVOC eq	kg Sb eq	MJ, net calorific value	m^3 world eq deprived	disease incidence
Product stage	Raw material supply	A1	3.99E-04	4.13E-03	1.39E-03	9.56E-06	3.02E+01	1.32E-02	1.19E-08
	Transport	A2	1.68E-05	1.91E-04	4.64E-05	2.10E-09	3.22E-01	2.18E-04	7.47E-10
	Manufacturing	A3	5.17E-05	2.76E-04	7.25E-05	7.86E-09	6.97E-01	4.14E-01	2.93E-09
	Total (of product stage)	A1-3	4.68E-04	4.60E-03	1.51E-03	9.57E-06	3.12E+01	4.27E-01	1.56E-08
Construction process stage	Construction	A5	3.28E-07	3.36E-06	1.04E-06	3.51E-11	2.84E-03	2.47E-04	7.21E-12
100% incineration scenario for plastic pipe & 100% recycling scenario for brass fittings									
End of life	Deconstruction, demolition	C1	2.69E-06	2.80E-05	6.67E-06	2.39E-09	7.40E-02	1.27E-04	6.68E-11
	Transport	C2	8.12E-07	9.64E-06	2.21E-06	2.13E-10	3.20E-02	2.23E-05	1.75E-11
	Waste processing	C3	2.54E-05	5.48E-04	7.51E-05	1.42E-09	1.67E-01	1.06E-01	7.44E-10
	Disposal	C4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-2.80E-04	-3.06E-03	-7.96E-04	-7.21E-06	-1.26E+01	-8.94E-03	-8.45E-09

EP-marine = Eutrophication potential, fraction of nutrients reaching marine end compartment;
EP-terrestrial = Eutrophication potential, accumulated exceedance;
POCP = Formation potential of tropospheric ozone;
ADP-mineral&metals = Abiotic depletion potential for non-fossil resources;
ADP-fossil = Depletion potential of the stratospheric ozone layer;
WDP = Water (user) deprivation potential, deprivation-weighted water consumption; and
PM = Particulate matter.

LCA Results (continued)

Parameters describing environmental impacts

			IRP	ETP-fw	HTP-c	HTP-nc	SQP
			kBq U^{235} eq	CTUe	CTUh	CTUh	dimensionless
Product stage	Raw material supply	A1	3.91E-02	1.37E+01	3.48E-10	1.84E-08	1.04E+00
	Transport	A2	8.46E-05	2.39E-01	4.82E-12	2.49E-10	1.07E-01
	Manufacturing	A3	3.42E-03	1.31E+00	5.38E-11	5.27E-09	2.55E+00
	Total (of product stage)	A1-3	4.26E-02	1.52E+01	4.07E-10	2.39E-08	3.70E+00
Construction process stage	Construction	A5	3.66E-05	1.64E-03	7.32E-14	6.38E-12	6.72E-04
100% incineration scenario for plastic pipe & 100% recycling scenario for brass fittings							
End of life	Deconstruction, demolition	C1	5.48E-04	2.80E-02	1.11E-12	4.44E-11	3.77E-02
	Transport	C2	8.51E-06	2.37E-02	4.80E-13	2.49E-11	1.10E-02
	Waste processing	C3	1.40E-03	7.24E-02	7.61E-12	2.54E-10	4.15E-02
	Disposal	C4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-4.94E-02	-1.85E+00	-8.10E-11	-4.55E-09	-1.76E-01

IRP = Potential human exposure efficiency relative to U235;
ETP-fw = Potential comparative toxic unit for ecosystems;
HTP-c = Potential comparative toxic unit for humans;
HTP-nc = Potential comparative toxic unit for humans; and
SQP = Potential soil quality index.

LCA Results (continued)

Parameters describing resource use, primary energy

			PERE	PERM	PERT	PENRE	PENRM	PENRT
			MJ	MJ	MJ	MJ	MJ	MJ
Product stage	Raw material supply	A1	1.20E+00	0.00E+00	1.20E+00	1.29E+01	1.73E+01	3.02E+01
	Transport	A2	1.79E-02	0.00E+00	1.79E-02	3.23E-01	0.00E+00	3.23E-01
	Manufacturing	A3	5.74E-02	2.67E-01	3.24E-01	4.66E-01	2.31E-01	6.98E-01
	Total (of product stage)	A1-3	2.68E-01	2.67E-01	1.54E+00	1.37E+01	1.75E+01	3.12E+01
Construction process stage	Construction	A5	2.68E-01	-2.67E-01	8.38E-04	2.34E-01	-2.31E-01	2.84E-03
100% incineration scenario for plastic pipe & 100% recycling scenario for brass fittings								
End of life	Deconstruction, demolition	C1	4.83E-02	0.00E+00	4.83E-02	7.40E-02	0.00E+00	7.40E-02
	Transport	C2	1.84E-03	0.00E+00	1.84E-03	3.21E-02	0.00E+00	3.21E-02
	Waste processing	C3	2.93E-02	0.00E+00	2.93E-02	1.75E+01	-1.73E+01	1.67E-01
	Disposal	C4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-1.62E-01	0.00E+00	-1.62E-01	-1.26E+01	0.00E+00	-1.26E+01

PERE = Use of renewable primary energy excluding renewable primary energy 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 resource

LCA Results (continued)

Parameters describing resource use, secondary materials and fuels, use of water

			SM	RSF	NRSF	FW
			kg	MJ net calorific value	MJ net calorific value	m^3
Product stage	Raw material supply	A1	1.81E-02	0.00E+00	0.00E+00	3.45E-03
	Transport	A2	0.00E+00	0.00E+00	0.00E+00	2.06E-05
	Manufacturing	A3	5.09E-03	0.00E+00	0.00E+00	1.63E-04
	Total (of product stage)	A1-3	2.32E-02	0.00E+00	0.00E+00	3.63E-03
Construction process stage	Construction	A5	0.00E+00	0.00E+00	0.00E+00	6.18E-06
100% incineration scenario for plastic pipe & 100% recycling scenario for brass fittings						
End of life	Deconstruction, demolition	C1	0.00E+00	0.00E+00	0.00E+00	2.27E-05
	Transport	C2	0.00E+00	0.00E+00	0.00E+00	2.11E-06
	Waste processing	C3	0.00E+00	0.00E+00	0.00E+00	2.49E-03
	Disposal	C4	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	0.00E+00	0.00E+00	0.00E+00	-1.16E-03

SM = Use of secondary material;
RSF = Use of renewable secondary fuels;
NRSF = Use of non-renewable secondary fuels;
FW = Net use of fresh water

LCA Results (continued)

Other environmental information describing waste categories

			HWD	NHWD	RWD
			kg	kg	kg
Product stage	Raw material supply	A1	4.30E-09	1.62E-02	4.58E-04
	Transport	A2	1.65E-11	5.01E-05	5.79E-07
	Manufacturing	A3	1.47E-10	1.07E-02	2.56E-05
	Total (of product stage)	A1-3	4.46E-09	2.70E-02	4.84E-04
Construction process stage	Construction	A5	6.54E-13	6.55E-04	2.32E-07
100% incineration scenario for plastic pipe & 100% recycling scenario for brass fittings					
End of life	Deconstruction, demolition	C1	2.69E-11	5.77E-05	5.93E-06
	Transport	C2	1.69E-12	5.03E-06	5.82E-08
	Waste processing	C3	2.83E-11	1.10E-02	9.41E-06
	Disposal	C4	0.00E+00	0.00E+00	0.00E+00
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-1.62E-09	-7.74E-03	-6.17E-04

HWD = Hazardous waste disposed;
NHWD = Non-hazardous waste disposed;
RWD = Radioactive waste disposed

LCA Results (continued)

Other environmental information describing output flows – at end of life

			CRU	MFR	MER	EE	Biogenic carbon (product)	Biogenic carbon (packaging)
			kg	kg	kg	MJ per energy carrier	kg C	kg C
Product stage	Raw material supply	A1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Transport	A2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Manufacturing	A3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.63E-03
	Total (of product stage)	A1-3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.63E-03
Construction process stage	Construction	A5	0.00E+00	4.75E-04	0.00E+00	2.48E-03	0.00E+00	-6.63E-03
100% incineration scenario for plastic pipe & 100% recycling scenario for brass fittings								
End of life	Deconstruction, demolition	C1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Transport	C2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Waste processing	C3	0.00E+00	1.74E-02	0.00E+00	2.42E+00	0.00E+00	0.00E+00
	Disposal	C4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

CRU = Components for reuse;
MFR = Materials for recycling

MER = Materials for energy recovery;
EE = Exported Energy

Scenarios and additional technical information

Scenarios and additional technical information			
Scenario	Parameter	Units	Results
A4 – Transport to the building site	Transport to the construction site		
	Fuel type / Vehicle type	Vehicle type	Truck-trailer, Euro 6, 34 - 40t gross weight / 27t payload. Diesel
	Distance:	km	100
	Capacity utilisation (incl. empty returns)	%	61%
	Mass of transported piping system	kg	0.411
A5 – Installation in the building	Packaging EoL treatment		
	PE Film to recycling	kg/m	0.0005
	Cardboard to landfill	kg/m	0.0008
	Wood to incineration	kg/m	0.0005
C1 to C4 End of life,	Piping system to incineration, recycling		
	Polypropylene incineration	kg/m	0.3754
	Brass recycling	kg/m	0.00174
	Glass flakes (reinforcement) incineration	kg/m	0.0117
Module D	Credits for module A5. Credits for module C3 from energy substitution.		

Summary, comments and additional information

Interpretation

The Aquatherm green/blue S/MF/MF-RP pipe (average product) has impacts dominated by module A1 which is the main contributor to impact indicators ODP, AP, EP marine, EP terrestrial, POCP, ADPE and ADPF. Module A3 has significant relative contributions for EP freshwater and WDP and both modules A1 and C3 showed comparable impacts for GWP.

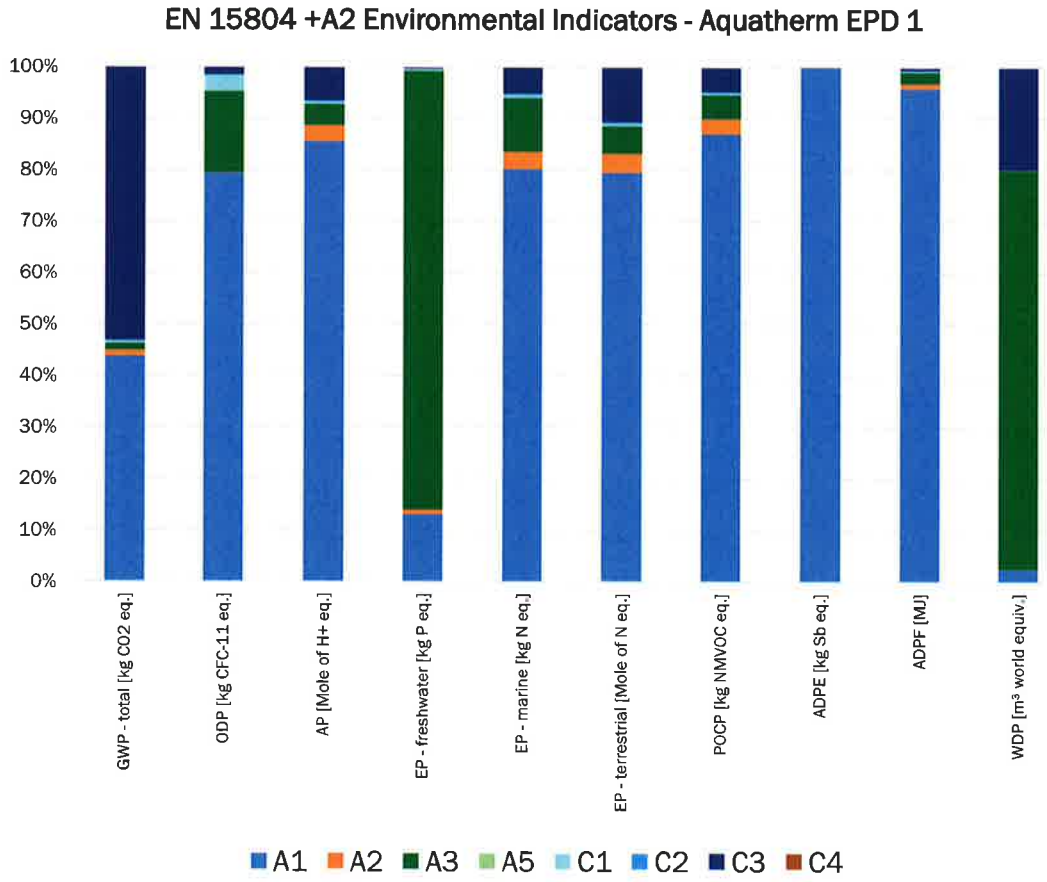


Figure 1: Relative contribution of declared modules to EN 15804 +A2 environmental indicators, excluding module D.

References

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