Environmental Product Declaration

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

ARCOSYSTEM®, sigma post mounted

from

Complete Composite Systems Ltd

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General information

Programme information

Programme:	The International EPD® System
Address:	EPD International AB Box 210 60 SE-100 31 Stockholm Sweden
Website:	www.environdec.com
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Accountabilities for PCR, LCA and independent, third-party verification
Product Category Rules (PCR)
CEN standard EN 15804 serves as the Core Product Category Rules (PCR)
Product Category Rules (PCR): EPD International Product Category Rules (PCR) for construction products (PCR 2019:14 v1.3.4). The product group classification for the assessed products is UN CPC 36990 (articles of plastic n.e.c.).
PCR review was conducted by: The Technical Committee of the International EPD System. See https://www.environdec.com/about-us/the-international-epd-system-about-the-system for a list of members. Review chair: Claudia Peña, University of Concepción, Chile. The review panel may be contacted via the Secretariat https://www.environdec.com/contact-us.
Life Cycle Assessment (LCA)
LCA accountability: Dr Matthew Fishwick, Fishwick Environmental Ltd
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: Dr Hüdai Kara – Managing Director at Metsims Sustainability Consulting 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 may not be comparable. For two EPDs to be comparable, they shall be based on the same PCR (including the same version number up to the first two digits) 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.

Company information

Owner of the EPD: Complete Composite Systems Ltd (CCS).

Contact: Ron Brown, Technical Director, Graylands, 503 Broadway, Letchworth, England, SG6 3PT, United Kingdom. +44(0)1462 379000. info@completecomposites.co.uk.

Description of the organisation: Complete Composite Systems Ltd designs, manufactures and markets quality composite and engineered plastic products.

Name and location of production site(s): The product assessed in this study is manufactured by a confidential contract manufacturer of Complete Composite Systems Ltd.

Product information

Product group name: ARCOSYSTEM®, sigma post mounted.

Product identification: ARCOSYSTEM®, sigma post mounted, represented by size 1 trough and lid, a single plane swivel post bracket on 1,500 mm post. 6 m spacing between posts/brackets is typically used. The justification for the choice of this representative product is that this is the most commonly installed combination of components (>70% of sales). The table below products the full list of ARCOSYSTEM®, sigma post mounted components used within the product group. A variety of combinations of these components can be used for the ARCOSYSTEM® and also different spacing of brackets, depending on the application.

Component	Channel size	Weight per declared unit (kg/m) – based on 6 m spacing
Sigma post 1.2 m	1 and 2	1.82
Sigma post 1.5 m*	**1 and 2**	**1.83**
Sigma post 1.9 m	1 and 2	2.37
Sigma post 2.5 m	1 and 2	3.12
Sigma post 3.0 m	1 and 2	3.73
90° Sigma post 210	1 and 2	1.08
90° Sigma post 210	1 and 2	0.94
Single plane swivel*	**1**	**0.75**
Single plane swivel	2	0.97
Straight connection plate	1	0.38
Straight connection plate	2	0.5

Component	Channel size	Weight per declared unit (kg/m) – based on 6 m spacing
Hinged swivel riser	1	1.03
Hinged swivel riser	2	1.33
Single plane swivel O/H post fixing	1	1.17
Single plane swivel O/H post fixing	2	1.47
Slim single plane swivel O/H post fixing	1	1.17
Slim single plane swivel O/H post fixing	2	1.47
Universal hinged O/H post swivel fixing	1	1.85
Universal hinged O/H post swivel fixing	2	2.08
Slim universal hinged O/H post swivel fixing	1	1.25
Trough and lid (6 m length)*	**1**	**5.29**
Trough and lid (6 m length)	2	7.80

**Components included in the representative product for ARCOSYSTEM®, sigma post mounted*

Product description: ARCOSYSTEM®, sigma post mounted, is a glass-fibre reinforced polyester (GRP) elevated cable duct system that efficiently protects multiple sensitive cables (cable loads of up to 90 kg/m). The versatility of ARCOSYSTEM® makes it suitable for a multitude of rail route settings. The lightweight GRP offers easy installation, while being non-conductive, weather resistant and having high mechanical stability. Fabricated from isophthalic polyester, the pultruded troughs and lids are supported on a dedicated range of high-quality steel sigma posts and bracketry that enables height and direction changes to be accommodated. ARCOSYSTEM®, sigma post mounted, provides a consistent, long-lasting system capable of withstanding the most extreme conditions. The lightweight GRP offers easy installation, while being non-conductive, weather resistant and having high mechanical stability. ARCOSYSTEM® is able to resist lateral forces from bank subsidence, high snow loads and wind effects from high speed trains, as well as being resistant to UV, fire and an array of corrosive chemicals. ARCOSYSTEM® provides a consistent, long-lasting cable management system capable of withstanding the most extreme conditions.

UN CPC code: The product group classification for the assessed product is UN CPC 36990 (articles of plastic n.e.c.).

Geographical scope: Europe (A1-A3), UK and Europe (A4, C1-4, D).

Further product information: https://www.completecomposites.co.uk/

LCA information

Declared unit: One linear metre of ARCOSYSTEM® size 1, sigma post mounted (trough and lid = 5.29 kg / m, post = 1.83 kg / m, bracket = 0.75 kg / m, total 7.87 kg / m).

Reference service life: n/a

Version history: version 2 updates comprise addition of packaging information to content declaration.

Time representativeness: 2022.

Database(s) and LCA software used: All secondary data were from Eugeos' 15804+A2_IA v4.1 extended version of ecoinvent v3.6 (cut-off), the LCA software openLCA (version 1.10.3) and Microsoft Excel were used for modelling.

Calculation method: As specified in EN 15804:2012+A2:2019 and the PCR 2019:14 v1.3.4, the environmental impacts are declared and reported using the baseline characterisation factors from the EC-JRC using EN 15804 reference package based on EF 3.1.

Description of system boundaries: The system boundary of a product system determines the unit processes to be included in the LCA study and which data as inputs and/or outputs to/from the system can be omitted. In this LCA study and resulting EPD, the system boundary includes extraction/cultivation of raw materials, processing of raw materials, production of the finished product, end-of-life and all transportation and waste stages until the grave stage. This “cradle-to-gate with options” boundary comprises the following modules given in EN 15804:2012+A2:2019: the product, construction, and end-of-life stages and benefits/loads beyond the system boundary (modules A1-A3, A4, C1-C4, D).

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

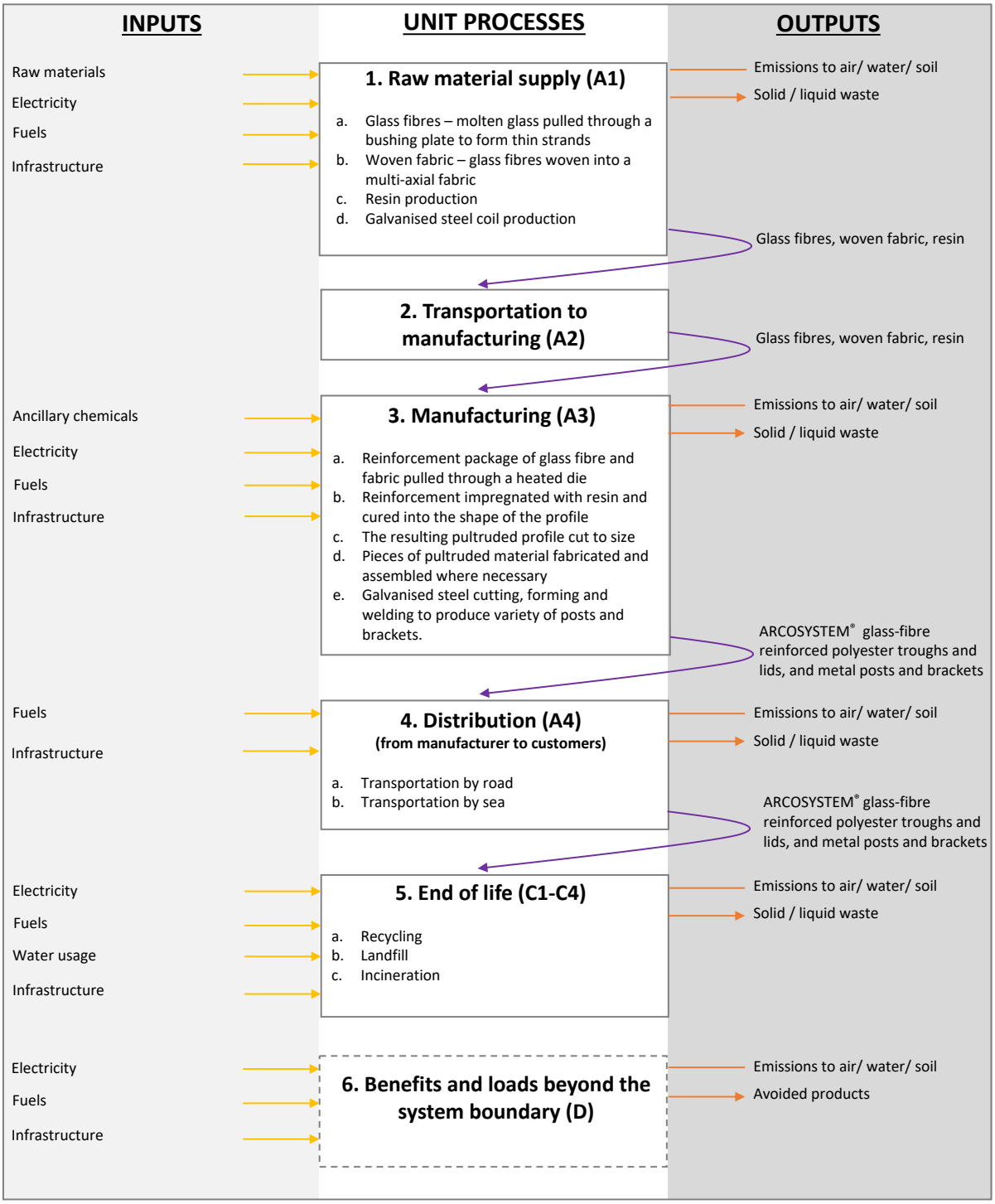
	Product stage			Construction process stage		Use stage							End of life stage				Resource recovery stage
Module	Raw material supply A1	Transport A2	Manufacturing A3	Transport A4	Construction installation A5	Use B1	Maintenance B2	Repair B3	Replacement B4	Refurbishment B5	Operational energy use B6	Operational water use B7	De-construction demolition C1	Transport C2	Waste processing C3	Disposal C4	Reuse-Recovery-Recycling-potential D
Modules declared	X	X	X	X	ND	ND	ND	ND	ND	ND	ND	ND	X	X	X	X	X
Geography	EU	EU	EU	EU/ UK	-	-	-	-	-	-	-	-	EU/UK				EU/UK
Specific data used	10%			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation – products	41%*			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation – sites	0%			-	-	-	-	-	-	-	-	-	-	-	-	-	-

X = included, ND = module not declared. Specific data used and variations are based on the GWP-GHG indicator.
**Note that the per kilogram impact of each post variant, bracket variant or trough and lid variant is identical and therefore impacts results for each component are directly proportional to mass.*

A3 electricity mix (brackets and posts): “market for electricity, medium voltage | electricity, medium voltage | Cutoff, U - DE” – ecoinvent v3.6 (cut-off), adjusted to create the residual mix by removing

renewables. GHG-GWP intensity: 0.73 kg CO_2e / kWh. Electricity fuel mix: 58% coal, 22% natural gas, 19% nuclear, 1% other.

System diagram:



Yellow line = input of material/energy, orange line = output of waste/direct emission, purple line = output of product/co-product, arrowhead on line = transportation stage considered.

Module A1 – raw material supply, comprising:

- Extraction and production of all raw materials for the production of ARCOSYSTEM® GRP troughs and lids, and sigma metal posts and brackets, comprising:
    - Glass fibres – molten glass pulled through a bushing plate to form thin strands.
    - Woven fabric – glass fibres woven into a multi-axial fabric.
    - Resin production.
    - Galvanised steel coil production.

Module A2 – transport, comprising:

- Transportation of glass fibres, woven fabric, resin, and galvanised steel coil to manufacturing site from direct suppliers.

Module A3 – manufacturing:

- Manufacturing of ARCOSYSTEM® units ready for transportation to customer, comprising:
    - Glass fibre and fabric pulled through a heated die and impregnated with resin and cured into the shape of the profile and cut to size.
    - Galvanised steel cutting, forming and welding to produce variety of post and brackets.

Module A4 – transport:

- Transportation of ARCOSYSTEM® GRP troughs and lids, and sigma metal posts and metal brackets from manufacturing site to the project site.
- Transportation to customer (A4) scenario parameters modelled in this EPD comprise:
    - Vehicle type used for transport: >32 tonne EURO 4 lorry (road).
    - Distance: 1,435 – 1,792 km road.
    - Capacity utilisation, including return trips: 37% (road).
    - Bulk density of transported products: <1,000 kg / m^3.
    - Volume capacity utilisation factor: 1.

Module C1-C4 – end-of-life:

- ARCOSYSTEM® units are removed using a manual process.
- Transportation of deconstructed ARCOSYSTEM® from the project site to the waste processing site.
- Waste processing and disposal via 100% incineration with energy recovery for troughs and lids and 100% recycling for posts and brackets.
- End-of-life (C1-C4) scenario parameters modelled in this EPD comprise:
    - Collection process specific by type: 7.88 kg collected separately and 0 kg collected with mixed construction waste.
    - Recovery system specified by type: 0 kg for re-use, 2.58 kg for recycling, and 5.30 kg for energy recovery.
    - Disposal specific by type: 0 kg product for final disposal (landfill).
    - Transportation assumptions: 50 km by municipal waste 21 metric ton lorry.

Module D – reuse, recovery, recycling potential:

- Benefits and loads beyond the system boundary (D) scenario parameters modelled in this EPD comprise:
    - Waste treatment scenario: 100% energy recovery for GRP and 100% recycling for steel.
    - For recycling, benefits were calculated using by subtracting the scrap input in A1-A3 (0.13 kg / kg) from the scrap output in module C (1 kg / kg), to derive 0.87 kg / kg. The avoided impact of this net scrap amount was modelled using ecoinvent data for convertor steel.

Loads from sorting, cleaning, recycling were considered using ecoinvent data, assuming the end-of-waste point was at the recycling centre.

- For energy recovery, benefits were calculated assuming UK residual mix electricity and the following assumptions. Loads were calculated assuming waste incineration
    - Conventional incineration with steam cycle electricity generation assumed;
    - Grid electricity the only avoided product; and waste heat not used, to adopt a conservative assumption;
    - Only 35% of the product is combustible (i.e. the resin component) and CV based on that of polyester resin of 35 MJ per kg; and
    - Overall electrical efficiency of energy from waste plant = 20% (minimum for electricity only, ERM, 2006).

Cut-off criteria and exclusions:

In the process of building an LCI it is typical to exclude items considered to have a negligible contribution to results. In order to do this in a consistent and robust manner there must be confidence that the exclusion is fair and reasonable. To this end, cut-off criteria were defined in this study, which allow items to be neglected if they meet the criteria. In accordance with EPD International's PCR for construction products (PCR 2019:14), exclusions could be made if they were expected to be within the below criteria:

- A process can be excluded if it contributes to <1% of the total mass or energy input of a unit process;
- A maximum of 5% of the total mass or energy of the lifecycle can be excluded; and
- The excluded process doesn't meet the following exceptions:
    - Significant effects on energy use in extraction, use or disposal;
    - Significant environmental relevance (i.e. likely to contribute to an increase/decrease in impacts of more than 1%); and
    - Are classed as hazardous waste.

The follow exclusions from the scope of the study were made:

- Human and animal energy inputs to processes;
- Transport of employees to and from their normal place of work and business travel;
- Environmental impacts associated with support functions (e.g. R&D, marketing, finance, management etc.);
- Packaging of incoming raw materials and ancillary materials (immaterial [calculated to be <1% of lifecycle impact for carbon footprint, which is a good proxy for many other impact categories]);
- Packaging of products (immaterial [calculated to be <1% of lifecycle impact for carbon footprint, which is a good proxy for many other impact categories]); and
- Storage of ARCOSYSTEM® troughs and lids, sigma posts and brackets (assumed to be immaterial as can be stored outside or ambiently).

Allocation procedures:

For cases where there is more than one product in the system being studied, EPD International's PCR for construction products (PCR 2019:14) prescribes the following procedure for the allocation of material and energy flows and environmental emissions.

- In the first instance, allocation should be avoided, by process sub-division.
- Where these methods are not applicable, the ISO 14040/44 requires that allocation reflects the physical relationships of the different products or functions. Allocation based on physical

relationships such as mass or energy is a practical interpretation of this and is an approach often used in LCA.
- For some processes, allocation based on mass is not considered appropriate and, in these cases, economic allocation is used.

In this study, allocation procedures for multi-product processes followed the approach above. In terms of co-product allocation of generic data, the main database used, ecoinvent v3.6 (cut-off), defaults to an economic allocation for most processes. However, in some cases a mass-based allocation is used, where there is a direct physical relationship. The allocation approach of specific ecoinvent modules is documented on their website and method reports (see www.ecoinvent.org).

In this study a “cut-off” method (aka recycled content or 100:0 approach) was applied to all cases of end-of-life allocation, including in the case of generic data, where the ecoinvent v3.6 with a cut-off by classification end-of-life allocation method was used. In this approach, environmental burdens and benefits of recycled / reused materials and recovered energy are given to the product system consuming them, rather than the system providing them and are quantified based on recycling content of the material under investigation. The cut-off point is where an end-of-waste state is reached, including any sorting, cleaning, and processing of waste prior to recycling, reuse, or energy recovery, following the “polluter pays principle”. This is a common approach in LCA for materials where there is a loss in inherent properties during recycling, the supply of recycled material exceeds demand and recycled content of the product is independent of whether it is recycled downstream. It is in conformance with the ISO standards on LCA, EN 15804, EN 15978 and is prescribed in EPD International’s PCR for construction products (PCR 2019:14). The exception to the use of this end-of-life allocation method was for module D, where net loads and benefits beyond the system boundary, are presented separately. The end-of-life scenario for ARCOSYSTEM®, is assumed to be 100% recycled for steel post and brackets, and 100% incinerated with energy recovery (with thermal efficiency >60%) for the GRP components.

Data sources:

Quantitative and qualitative data were collected for all processes within the system boundary and these data were used to compile the LCI. These comprised specific data (primary data) and generic data (secondary data). To explain the distinction between these categories, specific data directly refer to the product under investigation, for example the amount of electricity consumed at a Complete Composite Systems’ contract manufacturer’s site. Generic data do not directly refer to the product under investigation but refer to a similar process and fulfil the data quality criteria defined for this study.

Primary/specific data were sought as a preference and were collected from Complete Composite Systems’ contract manufacturers. These specific data were collected using data collection sheets via an iterative process and represent a time period spanning 2022/2023. Generic data were collected for all other lifecycle stages from Eugeos' 15804+A2_IA v4.1 extended version of ecoinvent v3.6 (cut-off).

Secondary/generic data were chosen to be to be as geographically specific as possible, however, this was not always possible. In these cases, a geography was selected to match the technology, feedstock source etc., as closely as possible.

Note that no energy values were calculated from volumes or masses of fuels by the LCA practitioners as they were provided in units of energy, however, volume and mass to energy unit conversions have been carried out in the ecoinvent v3.6 (cut-off) database and for this the lower heating value was used throughout.

Data quality: To ensure the quality of data were sufficient, data quality checks were completed in relation to time-related coverage, geographical coverage, technology coverage, completeness, and representativeness. Data quality indicators were applied using a data quality matrix whereby key data were assigned scores between 1 (best) and 5 (worst). All data scored between 1-3.

Content declaration

Product content	Mass, kg per declared unit	Post-consumer recycled material, weight-% of product	Biogenic material, mass-% of product	Biogenic material, kg C per declared unit
Resin based matrix	1.77	0	0	0
Glass fibre	3.52	0	0	0
Galvanised steel	2.58	0 [1]	0	0
TOTAL	**7.88**	**0**	**0**	**0**

[1] *Secondary data used for galvanised steel contains assumptions regarding recycled content based on market averages, however, it is not certain what proportion is post-consumer. Therefore, to adopt a conservative approach, no post-consumer recycled content is declared here.*

Packaging materials	Mass, kg per declared unit	Mass-% versus the declared unit	Biogenic material, kg C per declared unit
Wood frames/pallet	0.104	1.32	0.052
Steel belt	0.012	0.15	0.000
Plastic film	0.005	0.07	0.000
Cardboard	0.004	0.04	0.002
Polythene cover	0.001	0.02	0.000
TOTAL	**0.127**	**1.61**	**0.054**

Packaging for this product is minimal and is excluded due to immateriality. No substances that are listed in the “Candidate List of Substances of very high concern for authorisation” are contained in the declared unit. ARCOSYSTEM® products do not contain any substances hazardous to health or the environment (in particular carcinogenic, mutagenic, toxic to reproduction, allergic, PBT5 or vPvB6 substances).

Results of the environmental performance indicators

The environmental performance of one linear metre of ARCOSYSTEM® size 1, sigma post mounted. is declared and reported using the parameters and units as specified in PCR 2019:14 v1.3.4. These life cycle impact assessment results and other environmental results are presented in the tables below per declared unit, broken down by module.

Note that the LCIA results are relative expressions and do not predict impacts on category end-points, the exceeding of thresholds, safety margins or risks. It is discouraged to use the results of Modules A1-A3 without considering the results of other modules, particularly, Module C.

Mandatory impact category indicators according to EN 15804

Results per one linear metre of ARCOSYSTEM® size 1, sigma post mounted								
Indicator	**Unit**	**A1-A3**	**A4**	**C1**	**C2**	**C3**	**C4**	**D**
GWP-fossil	kg CO_2 eq.	2.74E+01	1.24E+00	0.00E+00	6.18E-02	6.22E-01	0.00E+00	-2.39E+00
GWP-biogenic	kg CO_2 eq.	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
GWP-luluc	kg CO_2 eq.	2.49E-02	3.91E-04	0.00E+00	5.50E-06	1.16E-05	0.00E+00	-2.51E-03
GWP-total	kg CO_2 eq.	2.74E+01	1.24E+00	0.00E+00	6.18E-02	6.22E+00	0.00E+00	-2.39E+00
ODP	kg CFC 11 eq.	3.62E-06	2.84E-07	0.00E+00	1.31E-08	4.24E-09	0.00E+00	-3.31E-07
AP	mol H^+ eq.	1.40E-01	5.75E-03	0.00E+00	3.72E-04	1.59E-04	0.00E+00	-2.72E-02
EP-freshwater	kg P eq.	1.09E-02	3.13E-04	0.00E+00	3.40E-06	3.98E-06	0.00E+00	-4.16E-03
EP-marine	kg N eq.	2.81E-02	1.87E-03	0.00E+00	1.59E-04	7.95E-05	0.00E+00	-5.07E-03
EP-terrestrial	mol N eq.	2.88E-01	2.02E-02	0.00E+00	1.74E-03	7.10E-04	0.00E+00	-5.26E-02
POCP	kg NMVOC eq.	1.16E-01	6.15E-03	0.00E+00	6.08E-04	1.77E-04	0.00E+00	-2.07E-02
ADP-minerals&metals*	kg Sb eq.	9.85E-03	2.11E-05	0.00E+00	3.69E-07	2.34E-07	0.00E+00	-9.16E-05
ADP-fossil*	MJ	4.28E+02	1.92E+01	0.00E+00	7.98E-01	1.34E-01	0.00E+00	-9.18E+01
WDP*	m^3	1.62E+02	6.76E+00	0.00E+00	4.85E-01	4.97E-01	0.00E+00	-1.08E+02
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.*
***Disclaimer: This impact category deals mainly with the eventual impact of low dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator.*

Additional mandatory and voluntary impact category indicators

Results per one linear metre of ARCOSYSTEM® size 1, sigma post mounted								
Indicator	**Unit**	**A1-A3**	**A4**	**C1**	**C2**	**C3**	**C4**	**D**
GWP-GHG[1]	kg CO_2 eq.	2.74E+01	1.24E+00	0.00E+00	6.18E-02	6.22E-01	0.00E+00	-2.39E+00
PM	Disease incidence	1.44E-06	1.12E-07	0.00E+00	8.40E-09	1.07E-09	0.00E+00	-4.04E-07
IRP**	kBq U235 eq.	2.30E+00	9.10E-02	0.00E+00	3.76E-03	1.01E-03	0.00E+00	-1.46E+00
ETP-fw*	CTUe	2.17E+02	7.98E-01	0.00E+00	4.16E-03	4.11E-03	0.00E+00	-1.38E+00
HTP-c*	CTUh	6.79E-08	3.47E-10	0.00E+00	6.31E-12	1.01E-10	0.00E+00	-4.05E-08
HTP-nc*	CTUh	1.17E-06	2.55E-08	0.00E+00	2.44E-10	6.53E-09	0.00E+00	-2.21E-07
SQP*	dimensionless	8.84E+01	2.78E+01	0.00E+00	7.90E-03	5.49E-03	0.00E+00	-2.89E+00

Resource use indicators

Results per one linear metre of ARCOSYSTEM® size 1, sigma post mounted								
Indicator	**Unit**	**A1-A3**	**A4**	**C1**	**C2**	**C3**	**C4**	**D**
PERE	MJ	2.93E+01	2.06E-01	0.00E+00	4.18E-03	1.09E-02	0.00E+00	-6.72E+00
PERM	MJ	3.45E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	MJ	3.28E+01	2.06E-01	0.00E+00	4.18E-03	1.09E-02	0.00E+00	-6.72E+00
PENRE	MJ	3.97E+02	1.95E+01	0.00E+00	8.03E-01	1.49E-01	0.00E+00	-1.11E+02
PENRM	MJ	3.92E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	MJ	4.36E+02	1.95E+01	0.00E+00	8.03E-01	1.49E-01	0.00E+00	-1.11E+02

[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.

SM	kg	3.85E-01	6.42E-03	0.00E+00	1.03E-04	1.43E-04	0.00E+00	-5.65E-01
RSF	MJ	4.36E-01	4.81E-03	0.00E+00	7.95E-05	2.73E-04	0.00E+00	-7.36E-02
NRSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	m^3	2.37E-01	1.17E-03	0.00E+00	8.65E-05	2.30E-04	0.00E+00	-2.61E-02
Acronyms	PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used as raw materials; PENRT = Total use of non-renewable primary energy re-sources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water							

Waste indicators

Results per one linear metre of ARCOSYSTEM® size 1, sigma post mounted								
Indicator	**Unit**	**A1-A3**	**A4**	**C1**	**C2**	**C3**	**C4**	**D**
Hazardous waste disposed	kg	2.45E+00	2.31E-02	0.00E+00	2.80E-04	4.65E-03	0.00E+00	-2.01E+00
Non-hazardous waste disposed	kg	2.95E+01	2.10E+00	0.00E+00	8.73E-03	2.88E-01	0.00E+00	-1.34E+01
Radioactive waste disposed	kg	6.61E-04	1.28E-04	0.00E+00	6.00E-06	4.03E-07	0.00E+00	-3.95E-04

Output flow indicators

Results per one linear metre of ARCOSYSTEM® size 1, sigma post mounted								
Indicator	**Unit**	**A1-A3**	**A4**	**C1**	**C2**	**C3**	**C4**	**D**
Components for re-use	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Material for recycling	kg	3.64E-01	5.61E-03	0.00E+00	9.00E-05	1.27E-04	0.00E+00	-1.07E-02
Materials for energy recovery	kg	9.38E-03	5.78E-05	0.00E+00	8.97E-07	2.82E-06	0.00E+00	-9.84E-04
Exported energy, electricity	MJ	4.04E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy, thermal	MJ	4.04E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Interpretation

The following conclusions can be drawn from this study:

- Raw material supply (A1) is the dominant hotspot for almost all impact categories;
- Manufacturing (A3) and transport to consumer (A4) make notable contributions to SQP, but minor contributions to all other impact categories; and
- All other modules make minor or immaterial contributions for all impact categories.

Additional environmental information

This EPD provides results for one linear meter of ARCOSYSTEM®, sigma post mounted, represented by size 1 trough and lid, a single plane swivel post bracket on 1,500 mm post, with 6 m spacing between posts/brackets, which represents the ARCOSYSTEM®, sigma post mounted product group. However, there are a number of components used within this product group (see table on page 3-4 of this EPD) and a variety of combinations of these components can be used along with different spacing of post/brackets, depending on the application. The per kilogram impact of each, post variant, bracket variant or trough and lid variant is identical and therefore impacts results for each component are directly proportional to mass. Results for other variants in the product range can be provided by Complete Composite Systems upon request by scaling results by the mass of each component used for your specific installation.

The variation in impact per linear meter is due to the combination of components chosen and therefore the mass of components needed per liner meter. This variation is >10% for all indicators, therefore the difference between declared results and those from the combination of components that are furthest away from these results are provided below for mandatory LCIA impact results (A1-A3 and A-C). The product variant with results furthest away from declared results is: size 2 trough and lid, a universal hinged O/H post swivel fixing (size 2) on 3,000 mm post, with 6 m spacing between posts/brackets.

Indicator	Unit	A1-A3 (%)	A-C (%)
GWP-fossil	kg CO_2 eq.	41%	41%
GWP-biogenic	kg CO_2 eq.	32%	38%
GWP-luluc	kg CO_2 eq.	38%	38%
GWP-total	kg CO_2 eq.	41%	41%
ODP	kg CFC 11 eq.	36%	36%
AP	mol H^+ eq.	40%	40%
EP-freshwater	kg P eq.	47%	47%
EP-marine	kg N eq.	40%	40%
EP-terrestrial	mol N eq.	40%	40%
POCP	kg NMVOC eq.	40%	40%
ADP-minerals&metals*	kg Sb eq.	54%	54%
ADP-fossil*	MJ	40%	40%

Indicator	Unit	A1-A3 (%)	A-C (%)
WDP*	m^3	55%	54%

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