Type III Environmental Product Declaration No. 368/2022

Issuance date: 26.09.2022
Validity date: 26.09.2027

Steel pipes and retention tanks

HelCor Pipe, HelCor PipeArch Pipes
ViaCon StormWater Tanks, WaterCor Tanks

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Basic information

This declaration is the Type III Environmental Product Declaration (EPD) based on EN 15804+A2 and verified according to ISO 14025 by an external auditor. It contains the information on the impacts of the declared construction materials on the environment and their aspects verified by the independent body according to ISO 14025. Basically, comparison or evaluation of EPD data is possible only if all the compared data were created according to EN 15804+A2.

Life cycle analysis (LCA): A1-A3, C2-C4 and D modules in accordance with EN 15804 (Cradle-to-Gate with options)

The year of preparing the EPD: 2022

Products standards: EN 1090-1

Service Life: 100 years

PCR: ITB-PCR A

Declared unit: 1 ton

Reasons for performing LCA: B2B

Representativeness: Polish, European

MANUFACTURER

ViaCon in Poland consists of three companies: ViaCon Sp. z o.o., ViaCon Polska Sp. z o.o. and ViaCon Construction Sp. z o.o. All of them are members of ViaCon Group, established in Sweden and Norway in 1986. At present ViaCon Group is made up of approximately 30 companies based in the following countries: Austria, Bulgaria, the Czech Republic, Denmark, Estonia, Finland, France, Lithuania, Latvia, Norway, Poland, Sweden, Hungary, Slovakia, Romania, Turkey and the United Arab Emirates. All companies mentioned above are a part of ViaCon Group that was acquired in September 2018 by Nordic Investment Fund FSN Capital.

Fig. 1. A view of ViaCon Sp. z o.o. in Rydzyna (Poland).

PRODUCTS DESCRIPTION AND APPLICATION

Steel pipes HelCor and HelCor PipeArch are helically corrugated steel products made of S250GD – S350GD steel grade. Complete system of helically corrugated pipes includes elbows or T-connections and also additional elements such as manholes, inspection chambers etc. According to the European Standard PN-EN 1991- 2 HelCor and HelCor PipeArch pipes can be used as engineering structures for every class of road and railway (up to V=200km/h).

HelCor and HelCor PipeArch pipes have Technical Approval issued by Polish Road and Bridge Research Institute (IBDiM). They have been approved for use in Scandinavia, The Baltic States, Switzerland, Hungary, Slovakia, The Czech Republic, Romania, Austria, The Ukraine, Belarus and other European countries. HelCor and HelCor PipeArch are approved by Polish Central Mining Institute (GIG) to be used on subsidence areas.

Steel used for the production of the pipes, as well as coupling bands conform to the European Standards of EN 10327 *"Continuously hot-dip coated strip and sheet of low carbon steels for cold forming – Technical delivery conditions"* and EN 10326 *"Continuously hot-dip coated strip and sheet of structural steels - Technical delivery conditions".* Steel is delivered in coils, with a protective coating: 600 g/m^2 zinc coating both sides, equivalent to 42 µm on each side, 1000 g/m^2 zinc coating both sides, equivalent to 70µm on each side, 600 g/m^2 zinc coating both sides, equivalent to 42µm on each side, with an additional 250µm polymer film (TrenchcoatTM or W-Protect®) on one or both sides.

The standard lengths of the HelCor pipes are 6 m, 7 m and 8 m, however the production process allows the manufacturing of any length of pipe.
The pipe-arches are produced in 6m long segments from HCPA-01 to HCPA-20 and 7 m and 8 m long segments from HCPA- 21 to HCPA-50.

Rentention tanks ViaCon StormWater Tanks and WaterCor Tanks are made of spiral corrugated pipes HelCor. Pipes and connections are watertight and protected against corrosion by hot dip galvanization and polymer coating. Tanks are designed for rain water and sewage store in range of pH = 3 – 12. The system demands less space and is more economical than other classic solutions. Diameters up to 3,6m and high capacity in a wide range of cover depth make the system perfect for solving the problem of rain water disposal in high developed areas.

The specification of the steel pipes and retention tanks manufactured by ViaCon Sp. z o.o. is listed in Table 1.

Table 1. The specification of the steel pipes and retention tanks manufactured by ViaCon Sp. z o. o

Product	Diameter, mm	Steel grade	Application
HelCor Pipes, HelCor PipeArch Pipes structures	300mm – 3600	S250GD – S350GD galvanized or trenchcoated	mainly in civil engineering as steel-soil composite structures bearing rail and road traffic loads
ViaCon StormWater Tanks WaterCor Tanks	300 – 3900	S250GD – S350GD galvanized, trenchcoated or painted	retention tanks infiltration tanks firewater tanks drinking water tanks perforated tanks sand and oil separators

LIFE CYCLE ASSESSMENT (LCA) – general rules applied

Allocation

The allocation rules used for this EPD are based on general ITB PCR A v. 1.5. Production of the steel pipes and retention tanks is a line process conducted in the manufacturing plant of ViaCon Sp. z o. o., located in Rydzyna (Poland). All impacts from raw materials extraction and processing are allocated in module A1 of the LCA. Impacts from the global line production of ViaCon Sp. z o. o. were inventoried and 100% was allocated to the production of the hot rolled steel profiles based on the products mass basis. Water and energy consumption, associated emissions and generated wastes are allocated to module A3.

System limits

The life cycle analysis (LCA) of the declared products covers: product stage – modules A1-A3, end of life – modules C2-C4 and benefits and loads beyond the system boundary – module D (cradle-to-gate with options) in accordance with EN 15804+A2 and ITB PCR A v. 1.5. Energy and water consumption, emissions as well as information on generated wastes were inventoried and were included in the calculations. It can be assumed that the total sum of omitted processes does not exceed 5% of all impact categories. In accordance with EN 15804+A2, machines and facilities

(capital goods) required for the production as well as transportation of employees were not included in LCA.

Modules A1 and A2: *Raw materials supply and transport*

Galvanized steel coils (100% BOF process), paints, ancillary materials and packaging materials come from local as well as foreign suppliers. Means of transport include lorries with loading capacity <10 t and > 16 t. European standards for average combustion were used for calculations.

Module A3: *Production*

A scheme of the steel pipes and retention tanks presented in Fig. 2.

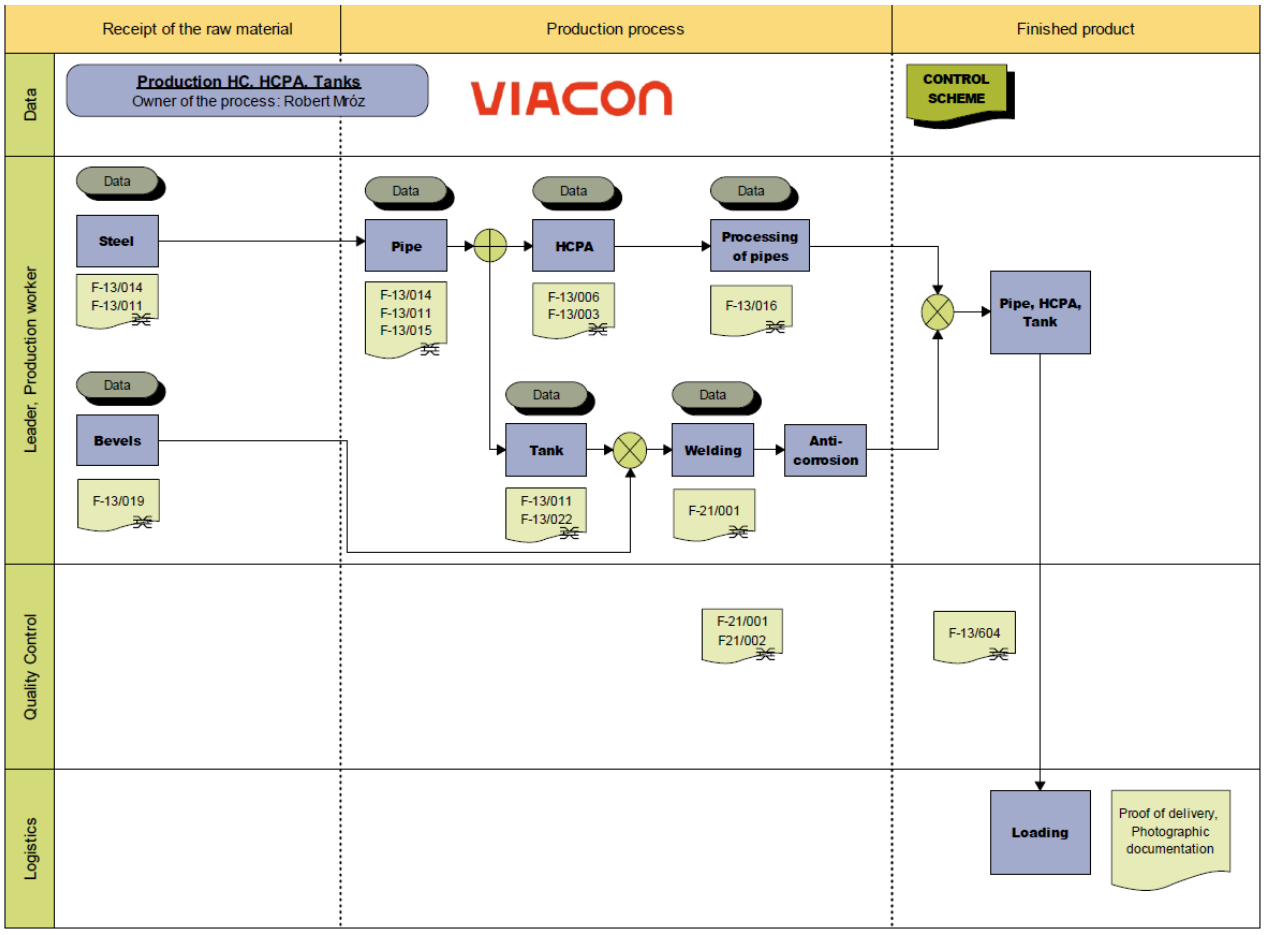

Fig. 2. A scheme of the steel pipes and retention tanks production process by ViaCon Sp. z o.o.

Modules *C2-C4 and D: End-of-life (EoL)*

Versatile application of the steel pipes and retention tanks excludes the possibility of precise modeling of impacts occurring at the deconstruction stage thus the module C1 is not declared within this EPD. In the adapted end-of-life scenario, the deconstructed steel pipes and retention tanks are transported to a waste processing plant distant by 70 km on > 16t lorry EURO 5, where undergo shredding. Module D presents credits resulting from the recycling of the primary steel scrap (100%), calculated in accordance with the net scrap approach developed by World Steel Association.

Table 2. End-of-life scenario for the steel pipes and retention tanks manufactured by ViaCon Sp. z o.o.

Material	Material recovery	Recycling	Landfilling
Steel scrap	100%	95%	5%

Data quality

The data selected for LCA originate from ITB-LCI questionnaires completed by ViaCon Sp. z o.o. using the inventoried data at the rolling mill, KOBiZE 2021 report, ITB database and Ecoinvent v.3.8. No specific data collected is older than five years and no generic datasets used are older than ten years. The representativeness, completeness, reliability, and consistency are judged as good.

Data collection period

Primary data provided by ViaCon Sp. z o. o. covers a period form 01.01.2021 to 31.12.2021 (1 year). The life cycle assessments were prepared for Poland and Europe as reference area.

Assumptions and estimates

The impacts of the representative steel pipes and retention tanks were aggregated using weighted average. Impacts were inventoried and calculated for all steel pipes and retention tanks manufactured by ViaCon Sp. z o. o.

Calculation rules

LCA was performed using ITB-LCA tool developed in accordance with EN 15804+A2.

Databases

The data for the LCA calculation comes from specific EPDs (steel blooms), KOBiZE, Ecoinvent v.3.8 and ITB Database. Specific data quality analysis was a part of an external audit.

LIFE CYCLE ASSESSMENT (LCA) – Results

Declared unit

The declaration refers to declared unit (DU) – 1 ton of the steel pipes and retention tanks manufactured by ViaCon Sp. z o.o.

Table 3. System boundaries for the environmental characteristic of the steel pipes and retention tanks.

Environmental assessment information (MD – Module Declared, MND – Module Not Declared, INA – Indicator Not Assessed)																
Product stage			Construction process		Use stage							End of life				Benefits and loads beyond the system boundary
Raw material supply	Transport	Manufacturing	Transport to construction site	Construction-installation process	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction 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**
MD	**MD**	**MD**	**MND**	**MND**	**MND**	**MND**	**MND**	**MND**	**MND**	**MND**	**MND**	**MND**	**MD**	**MD**	**MD**	**MD**

*Table 4. Life cycle assessment (LCA) results of **the steel pipes** manufactured by ViaCon Sp. z o. o. – environmental impacts (DU: 1 ton)*

Indicator	Unit	A1	A2	A3	A1-A3	C2	C3	C4	D
Global Warming Potential	eq. kg CO_2	2.18E+03	4.25E+00	2.07E+01	2.20E+03	4.87E-01	2.38E+01	2.64E-01	-8.69E+02
Greenhouse gas potential - fossil	eq. kg CO_2	2.16E+03	4.24E+00	2.04E+01	2.19E+03	4.85E-01	2.38E+01	2.63E-01	-1.82E+03
Greenhouse gas potential - biogenic	eq. kg CO_2	1.30E+01	1.45E-02	3.27E-01	1.33E+01	1.66E-03	2.04E-02	6.71E-04	-4.08E+00
Global warming potential - land use and land use change	eq. kg CO_2	3.60E+00	1.66E-03	4.72E-03	3.61E+00	1.90E-04	2.35E-03	2.49E-04	-7.65E-01
Stratospheric ozone depletion potential	eq. kg CFC 11	1.22E-04	9.80E-07	4.16E-06	1.27E-04	1.12E-07	5.04E-06	1.07E-07	-8.62E-05
Soil and water acidification potential	eq. mol H+	2.99E+01	1.72E-02	2.03E-01	3.01E+01	1.97E-03	1.19E-01	2.48E-03	-6.60E+00
Eutrophication potential - freshwater	eq. kg P	1.15E+00	2.85E-04	2.99E-02	1.18E+00	3.26E-05	7.31E-04	2.45E-05	-9.09E-01
Eutrophication potential - seawater	eq. kg N	2.66E+00	5.19E-03	2.84E-02	2.69E+00	5.94E-04	4.62E-02	8.62E-04	-1.56E+00
Eutrophication potential - terrestrial	eq. mol N	1.16E+02	5.66E-02	2.52E-01	1.16E+02	6.48E-03	5.06E-01	9.43E-03	-1.64E+01
Potential for photochemical ozone synthesis	eq. kg NMVOC	1.02E+01	1.73E-02	7.59E-02	1.03E+01	1.98E-03	1.43E-01	2.74E-03	-8.64E+00
Potential for depletion of abiotic resources - non-fossil resources	eq. kg Sb	7.15E-02	1.50E-05	2.65E-05	7.15E-02	1.72E-06	1.23E-05	6.04E-07	-2.65E-03
Abiotic depletion potential - fossil fuels	MJ	2.39E+04	6.29E+01	5.00E+02	2.44E+04	7.20E+00	3.17E+02	7.22E+00	-1.89E+04
Water deprivation potential	eq. m^3	1.08E+03	2.91E-01	5.72E+00	1.08E+03	3.33E-02	8.51E-01	2.29E-02	-8.06E+02

*Table 5. Life cycle assessment (LCA) results of **the steel pipes** manufactured by ViaCon Sp. z o. o. – additional impacts indicators (DU: 1 ton)*

Indicator	Unit	A1	A2	A3	A1-A3	C2	C3	C4	D
Particulate matter	disease incidence	INA	INA	INA	INA	INA	INA	INA	INA
Potential human exposure efficiency relative to U235	eg. kBq U235	INA	INA	INA	INA	INA	INA	INA	INA
Potential comparative toxic unit for ecosystems	CTUe	INA	INA	INA	INA	INA	INA	INA	INA
Potential comparative toxic unit for humans (cancer effects)	CTUh	INA	INA	INA	INA	INA	INA	INA	INA
Potential comparative toxic unit for humans (non-cancer effects)	CTUh	INA	INA	INA	INA	INA	INA	INA	INA
Potential soil quality index	dimensionless	INA	INA	INA	INA	INA	INA	INA	INA

*Table 6. Life cycle assessment (LCA) results of **the steel retention tanks** manufactured by ViaCon Sp. z o. o. – the resource use (DU: 1 ton)*

Indicator	Unit	A1	A2	A3	A1-A3	C2	C3	C4	D
Consumption of renewable primary energy - excluding renewable primary energy sources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Consumption of renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Total consumption of renewable primary energy resources	MJ	1.27E+03	9.02E-01	1.99E+01	1.29E+03	1.03E-01	1.82E+00	6.27E-02	-8.16E+02
Consumption of non-renewable primary energy - excluding renewable primary energy sources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Consumption of non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Total consumption of non-renewable primary energy resources	MJ	2.49E+04	6.29E+01	5.33E+02	2.55E+04	7.20E+00	3.44E+02	7.22E+00	-1.99E+04
Consumption of secondary materials	kg	2.51E+02	2.11E-02	3.08E-02	2.51E+02	2.41E-03	1.24E-01	1.52E-03	-2.34E+02
Consumption of renewable secondary fuels	MJ	8.30E-02	2.32E-04	1.86E-04	8.34E-02	2.66E-05	4.06E-04	3.96E-05	-6.27E-02
Consumption of non-renewable secondary fuels	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Net consumption of freshwater resources	m^3	2.43E+01	7.91E-03	2.22E-01	2.45E+01	9.05E-04	5.70E-03	7.90E-03	-1.78E+01

*Table 7. Life cycle assessment (LCA) results of **the steel retention tanks** manufactured by ViaCon Sp. z o. o. – waste categories (DU: 1 ton)*

Indicator	Unit	A1	A2	A3	A1-A3	C2	C3	C4	D
Hazardous waste neutralized	kg	3.58E+02	7.06E-02	7.25E-02	3.59E+02	8.08E-03	8.86E-04	7.67E-03	-3.16E+02
Non-hazardous waste neutralised	kg	4.16E+03	1.25E+00	5.14E+00	4.17E+03	1.43E-01	4.32E-01	1.08E-01	-3.37E+03
Radioactive waste	kg	4.63E-02	4.33E-04	1.85E-03	4.86E-02	4.96E-05	2.24E-03	4.79E-05	-4.00E-02
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	0.00E+00
Materials for recycling	kg	2.65E-01	1.95E-04	6.33E-01	8.98E-01	2.23E-05	4.23E-04	1.44E-05	-1.44E-01
Materials for energy recovery	kg	1.34E-03	1.57E-06	5.91E-06	1.35E-03	1.80E-07	6.77E-06	1.71E-07	-4.59E-04
Energy exported	MJ per energy carrier	7.07E+01	6.98E-02	8.39E-01	7.17E+01	7.99E-03	1.39E+00	0.00E+00	-3.22E+01

*Table 8. Life cycle assessment (LCA) results of **the steel retention tanks** manufactured by ViaCon Sp. z o. o. – environmental impacts (DU: 1 ton)*

Indicator	Unit	A1	A2	A3	A1-A3	C2	C3	C4	D
Global Warming Potential	eq. kg CO_2	2.31E+03	4.25E+00	2.07E+01	2.33E+03	4.87E-01	2.38E+01	2.64E-01	-1.08E+03
Greenhouse gas potential - fossil	eq. kg CO_2	2.29E+03	4.24E+00	2.04E+01	2.32E+03	4.85E-01	2.38E+01	2.63E-01	-2.03E+03
Greenhouse gas potential - biogenic	eq. kg CO_2	1.51E+01	1.45E-02	3.27E-01	1.54E+01	1.66E-03	2.04E-02	6.71E-04	-1.36E+01
Global warming potential - land use and land use change	eq. kg CO_2	3.46E+00	1.66E-03	4.72E-03	3.47E+00	1.90E-04	2.35E-03	2.49E-04	-1.25E+00
Stratospheric ozone depletion potential	eq. kg CFC 11	1.28E-04	9.80E-07	4.16E-06	1.33E-04	1.12E-07	5.04E-06	1.07E-07	-1.14E-04
Soil and water acidification potential	eq. mol H+	3.05E+01	1.72E-02	2.03E-01	3.07E+01	1.97E-03	1.19E-01	2.48E-03	-2.80E+01
Eutrophication potential - freshwater	eq. kg P	1.21E+00	2.85E-04	2.99E-02	1.24E+00	3.26E-05	7.31E-04	2.45E-05	-1.08E+00
Eutrophication potential - seawater	eq. kg N	2.78E+00	5.19E-03	2.84E-02	2.81E+00	5.94E-04	4.62E-02	8.62E-04	-2.49E+00
Eutrophication potential - terrestrial	eq. mol N	1.17E+02	5.66E-02	2.52E-01	1.17E+02	6.48E-03	5.06E-01	9.43E-03	-1.09E+02
Potential for photochemical ozone synthesis	eq. kg NMVOC	1.07E+01	1.73E-02	7.59E-02	1.08E+01	1.98E-03	1.43E-01	2.74E-03	-9.56E+00
Potential for depletion of abiotic resources - non-fossil resources	eq. kg Sb	7.31E-02	1.50E-05	2.65E-05	7.32E-02	1.72E-06	1.23E-05	6.04E-07	-6.72E-02
Abiotic depletion potential - fossil fuels	MJ	2.53E+04	6.29E+01	5.00E+02	2.58E+04	7.20E+00	3.17E+02	7.22E+00	-2.23E+04
Water deprivation potential	eq. m^3	1.12E+03	2.91E-01	5.72E+00	1.13E+03	3.33E-02	8.51E-01	2.29E-02	-1.00E+03

*Table 9. Life cycle assessment (LCA) results of **the steel retention tanks** manufactured by ViaCon Sp. z o. o. – additional impacts indicators (DU: 1 ton)*

Indicator	Unit	A1	A2	A3	A1-A3	C2	C3	C4	D
Particulate matter	disease incidence	INA	INA	INA	INA	INA	INA	INA	INA
Potential human exposure efficiency relative to U235	eg. kBq U235	INA	INA	INA	INA	INA	INA	INA	INA
Potential comparative toxic unit for ecosystems	CTUe	INA	INA	INA	INA	INA	INA	INA	INA
Potential comparative toxic unit for humans (cancer effects)	CTUh	INA	INA	INA	INA	INA	INA	INA	INA
Potential comparative toxic unit for humans (non-cancer effects)	CTUh	INA	INA	INA	INA	INA	INA	INA	INA
Potential soil quality index	dimensionless	INA	INA	INA	INA	INA	INA	INA	INA

*Table 10. Life cycle assessment (LCA) results of **the steel retention tanks** manufactured by ViaCon Sp. z o. o. – the resource use (DU: 1 ton)*

Indicator	Unit	A1	A2	A3	A1-A3	C2	C3	C4	D
Consumption of renewable primary energy - excluding renewable primary energy sources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Consumption of renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Total consumption of renewable primary energy resources	MJ	1.43E+03	9.02E-01	1.99E+01	1.45E+03	1.03E-01	1.82E+00	6.27E-02	-1.15E+03
Consumption of non-renewable primary energy - excluding renewable primary energy sources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Consumption of non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Total consumption of non-renewable primary energy resources	MJ	2.63E+04	6.29E+01	5.33E+02	2.69E+04	7.20E+00	3.44E+02	7.22E+00	-2.33E+04
Consumption of secondary materials	kg	3.04E+02	2.11E-02	3.08E-02	3.04E+02	2.41E-03	1.24E-01	1.52E-03	-2.36E+02
Consumption of renewable secondary fuels	MJ	9.71E-02	2.32E-04	1.86E-04	9.75E-02	2.66E-05	4.06E-04	3.96E-05	-7.04E-02
Consumption of non-renewable secondary fuels	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Net consumption of freshwater resources	m^3	2.55E+01	7.91E-03	2.22E-01	2.57E+01	9.05E-04	5.70E-03	7.90E-03	-2.27E+01

*Table 11. Life cycle assessment (LCA) results of **the steel retention tanks** manufactured by ViaCon Sp. z o. o. – waste categories (DU: 1 ton)*

Indicator	Unit	A1	A2	A3	A1-A3	C2	C3	C4	D
Hazardous waste neutralized	kg	3.59E+02	7.06E-02	7.25E-02	3.60E+02	8.08E-03	8.86E-04	7.67E-03	-3.36E+02
Non-hazardous waste neutralised	kg	4.25E+03	1.25E+00	5.14E+00	4.26E+03	1.43E-01	4.32E-01	1.08E-01	-3.88E+03
Radioactive waste	kg	5.04E-02	4.33E-04	1.85E-03	5.27E-02	4.96E-05	2.24E-03	4.79E-05	-4.32E-02
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	0.00E+00
Materials for recycling	kg	2.78E-01	1.95E-04	6.33E-01	9.11E-01	2.23E-05	4.23E-04	1.44E-05	-2.48E-01
Materials for energy recovery	kg	2.00E-03	1.57E-06	5.91E-06	2.01E-03	1.80E-07	6.77E-06	1.71E-07	-1.24E-03
Energy exported	MJ per energy carrier	8.09E+01	6.98E-02	8.39E-01	8.18E+01	7.99E-03	1.39E+00	0.00E+00	-6.59E+01

Verification

The process of verification of this EPD is in accordance with ISO 14025 and ISO 21930. After verification, this EPD is valid for a 5-year-period. EPD does not have to be recalculated after 5 years, if the underlying data have not changed significantly.

The basis for LCA analysis was EN 15804 and ITB PCR A
Independent verification corresponding to ISO 14025 (subclause 8.1.3.) ☒ external ☐ internal
External verification of EPD: Halina Prejzner, PhD Eng LCA, LCI audit and input data verification: Justyna Tomaszewska, PhD Eng, j.tomaszewska@itb.pl Verification of LCA: Michał Piasecki, PhD, DSc, Eng

Normative references

- ITB PCR A General Product Category Rules for Construction Products
- ISO 14025:2006, Environmental labels and declarations – Type III environmental declarations – Principles and procedures
- ISO 21930:2017 Sustainability in buildings and civil engineering works – Core rules for environmental product declarations of construction products and services
- ISO 14044:2006 Environmental management – Life cycle assessment – Requirements and guidelines
- ISO 15686-1:2011 Buildings and constructed assets – Service life planning – Part 1: General principles and framework
- ISO 15686-8:2008 Buildings and constructed assets – Service life planning – Part 8: Reference service life and service-life estimation
- EN 15804:2012+A2:2019 Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products
- ISO 14067:2018 Greenhouse gases — Carbon footprint of products — Requirements and guidelines for quantification
- PN-EN 15942:2012 Sustainability of construction works – Environmental product declarations – Communication format business-to-business
- ISO 20915:2018 Life cycle inventory calculation methodology for steel products
- PN-EN 1090-1+A1:2012 Wykonanie konstrukcji stalowych i aluminiowych -- Część 1: Zasady oceny zgodności elementów konstrukcyjnych
- KOBiZE Wskaźniki emisyjności CO2, SO2, NOx, CO i pyłu całkowitego dla energii elektrycznej. Grudzień 2021
- World Steel Association 2017 Life Cycle inventory methodology report for steel products