Environmental Product Declaration

In accordance with ISO 14025 and EN 15804 for:

PENETRON Products

from

PENETRON https://www.penetron.com/

Programme:	The International EPD® System, www.environdec.com
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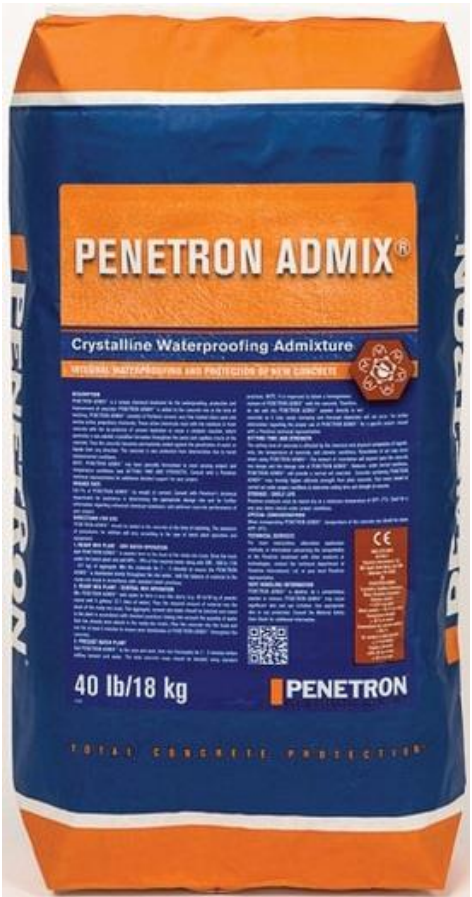

Programme information

Programme:	The International EPD® System EPD International AB Box 210 60 SE-100 31 Stockholm Sweden www.environdec.com info@environdec.com

Product category rules (PCR): *The International EPD System Product Category Rules and PCR Basic Module. Construction Products and Construction Services. Version 1.0. 2012 CPC:375 and Sub-PCR-G Concrete and concrete elements (EN16757-2017)*
Independent verification of the declaration and data, according to EN ISO 14025:2010: ☐ internal ☒ external
Third party verifier: *Angela Fisher, Aspire Sustainability* *In case of recognised individual verifiers:* 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 from different programmes may not be comparable. EPDs of construction products may not be comparable if they do not comply with EN 15804.

Company information

Owner of the EPD:
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Description of the organisation:
Founded in the late 1970s, PENETRON developed cementitious waterproofing products and additives to create an optimal crystalline technology. The know-how and experience gained over the past 40 years has enabled PENETRON to offer a broad range of concrete solutions, including crystalline waterproofing, water-stops and liquid sealers. The PENETRON system has been proven effective on countless major projects worldwide. The technical excellence of the products and a knowledgeable and dependable team of people have made the company the industry leader.

Name and location of production site: The EPD refers to the production of PENETRON Products, namely PENETRON ADMIX® and PENETRON® in the manufacturing site, placed in Allentown, Pennsylvania - USA.

Product information

Product name: PENETRON products: PENETRON ADMIX® and PENETRON®

Product identification: PENETRON products

Product description:
PENETRON ADMIX® is a grey powder with pH equal to 10-13, mostly consisting of Portland cement and various active, proprietary chemicals. It is a permeability-reducing admixture for hydrostatic conditions. PENETRON ADMIX® provides protection against concrete deterioration caused by chemical attack, freeze-thaw cycles, and corrosion, while withstanding high hydrostatic pressure and when added to the concrete mix at the time of batching. Applications of PENETRON ADMIX® include: reservoirs; sewage and water treatment plants; secondary containment structures; tunnels and subway systems; underground vaults; foundations; parking structures; swimming pools; precast, cast-in-place and shotcrete applications. The addition of PENETRON ADMIX® to concrete allows an increase of the durability and, therefore, of concrete elements/structures service life.

PENETRON ADMIX® manufacturing process include the raw material supply, the transportation of all raw materials to manufacturing site, their addition in the blender and the packaging of the final product, including bagging, wrapping, palletizing. The product is then moved to the stocking area.

PENETRON® is a surface-applied, integral crystalline waterproofing material, which waterproofs and protects concrete in-depth, also against seawater, wastewater, aggressive groundwater and many other aggressive chemical solutions. It is a grey powder with pH equal to 12,5, consisting of Portland cement, specially treated quartz sand and a compound of active chemicals. When PENETRON® is applied to a concrete surface, the active chemicals react with moisture and the by-products of cement hydration to cause a catalytic reaction that generates an insoluble, crystalline structure. The crystals fill the pores and minor shrinkage cracks in the concrete to prevent any further water ingress, without obstructing vapor passage. PENETRON® can be applied only with the addition of water, and the amount differ from the application method

and the surface direction. Applications of PENETRON® include: basement retaining walls; parking structures; concrete slabs; tunnels and subway systems; construction joints; foundations; water retaining structures; underground vaults; swimming pools; sewage and water treatment plants; channels; reservoirs; bridges, dams and roads. PENETRON® manufacturing process starts with the raw material supply and transportation of all raw materials to manufacturing site. Then, bulk materials are transferred in the blender by air or by screw conveyors. In parallel, the other raw materials are transported via LGP forklift next to the blender and are manually added to bulk materials. Paper waste derived from packed raw materials is sent to Easton (PA) landfill via truck. The blender mixes all the raw materials by using electric energy for, approximately, 5 minutes. After blending, PENETRON products are ready to be packed. The product is added in paper bags and moved through conveyor belts and palletized on wooden pallets, stretch wrap using a stretch film and put into stock via LGP forklift. Wooden pallets are returned to the supplier factory, so they can reuse them. For all manufacturing processes, dust is collected through a suction Dust Collector. Moreover, compressed air, used for seals, actuators and movement of raw materials is generated through an Air Generator.

UN CPC code: 375
Geographical scope: USA

LCA information

Functional unit / declared unit: 1 kg of PENETRON product
Reference service life: Not Applicable
Time representativeness: Information on the production of PENETRON products has been collected in November 2019-January 2020, based on average data related to the period September 2018-September 2019. All generic data refer to the ecoinvent v3.5 database, including updated datasets
Database and LCA software used: ecoinvent v.3.5 and SimaPro v9.0. ecoinvent data sets used for PENETRON products modelling have been updated within last 10 years.
System diagram: A1-A3 Modules
Description of system boundaries: Cradle-to-gate. A flow diagram describing the system boundary is provided in Figure 1 and declared modules are identified in Figure 2 (MNA=Module Not Assessed).
A1 module includes the supply of raw materials reported in the “Content declaration” section.
A2 Module includes the transportation of each raw material to the manufacturing site.
A3 Module includes all the activities/processes taking place in the manufacturing site.
Excluded lifecycle stages: Modules B, C and D are not considered because the precise function of the product at the building level is unknown

Allocation and Cut-off rules: According to the reference PCR, in Life Cycle Inventory, the minimum percentage of total mass and energy flows equal to 95% has been respected, considering the flows included in the modules A1-A3 of the system boundary. No allocations were made to the input or output data of PENETRON products since PENETRON does not report co-products nor reuse, recycling or recovery of flows during its internal manufacturing processes.
Assumptions and Estimates: Estimation has been done on waste from packed raw material (amount of 10kg of paper waste for 1 ton of PENETRON product manufactured has been considered). The amount of kraft paper for bagging, pallets and packaging film for packaging have been estimated according to ecoinvent data “packing, lime product, Global”. Assumption that all raw materials are transported by truck (16-32 metric ton, euro5). Assumption that all machines involved in the manufacturing process last 50 years (manufacturing processes are modelled considering the energy consumption related to the production of 1kg of PENETRON products and general data on machines production).
Data collection: Specific data have been collected in October 2019-January 2020 regarding the period from September 2018 to

September 2019. Calculations have been performed for energy consumption, starting from the motor ratings and the time each motor runs during the production of a batch of each material, for each product. The waste is determined by calculating how much raw material packaging is discarded during the production of a batch. A minimal amount of waste (about 50-100 lbs/100 tons produced) collected in the dust collection system is just added into the paper waste when calculating the total amount of waste. Distances are evaluated by using google maps. Emissions are equal to 0.
Generic data have been used for the sub-materials and sub-processes where specific data were not available, i.e. background materials/processes. Sources of generic data are ecoinvent v3.5 (data from allocation, cut-off by classification) and literature data.

More information:
https://www.penetron.com/products/PENETRON-ADMIX and
https://www.penetron.com/products/PENETRON
Name and contact information of LCA practitioner: Maria Chiara Caruso, Stress S.c.ar.l. email: mariachiara.caruso@stress-scarl.it

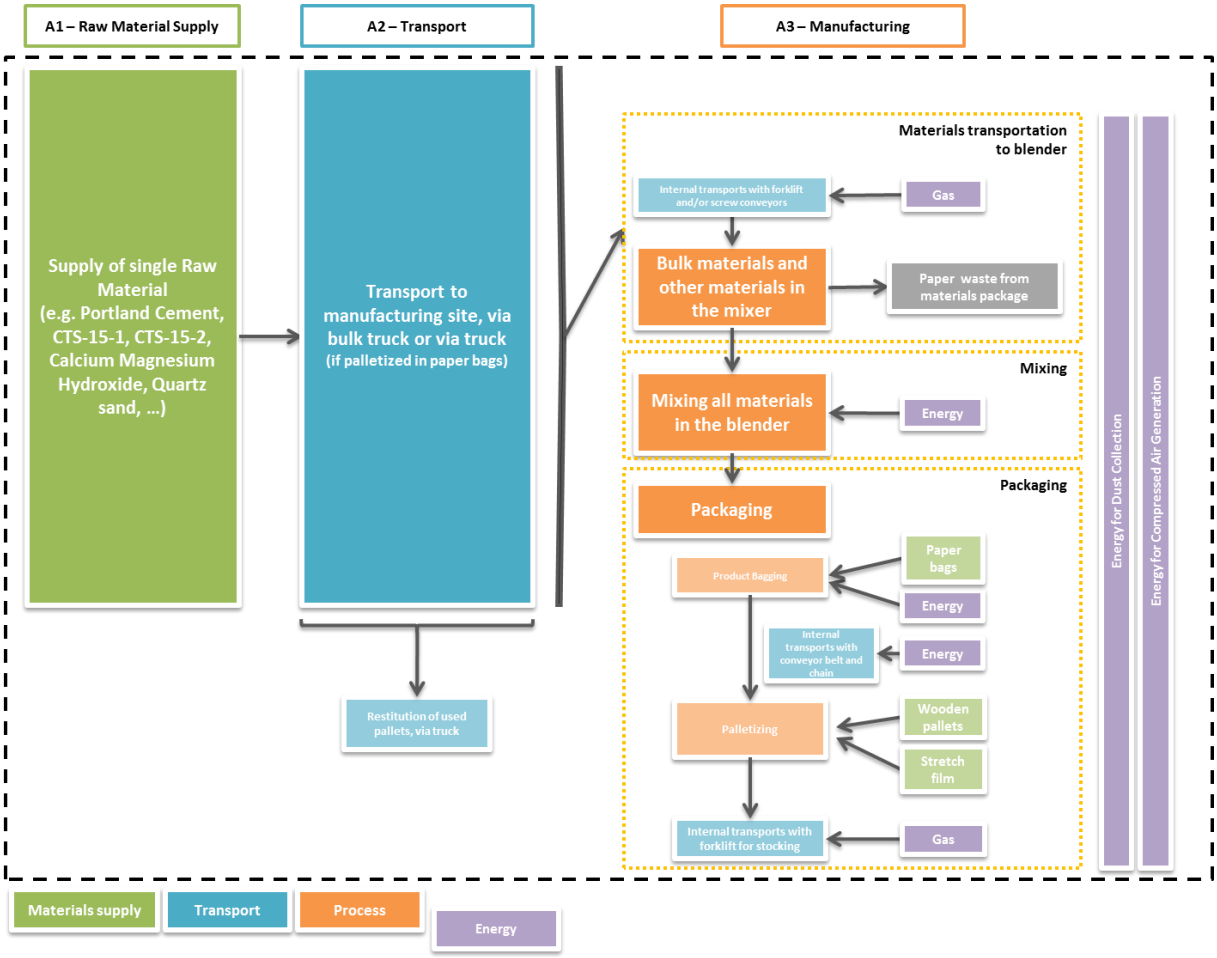

Figure 1: Flow diagram describing the PENETRON products system boundary

Life cycle stage	PRODUCTION			CONSTRUCTION		USE							END OF LIFE				BENEFITS
Modules	*A1*	*A2*	*A3*	*A4*	*A5*	*B1*	*B2*	*B3*	*B4*	*B5*	*B6*	*B7*	*C1*	*C2*	*C3*	*C4*	*D*
	Raw material supply	Transport	Manufacturing	Transport	Construction	Use	Maintenance	Repair	Replace	Refurbishment	Operation energy use	Operational water use	Demolition	Transport	Waste processing	Disposal	Reuse/ Recovery/ recycling potential
Cradle to gate	X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND

Figure 2: Flow diagram of the LCA study of PENETRON products according to EN 15804

Content declaration

Product

PENETRON ADMIX®

Materials / chemical substances	[Unit]	%	Environmental / hazardous properties
Cement, portland, chemicals	kg	65-80	No environmental or hazardous properties for all the product materials are present
CTS-15-1	kg	10-30	
CTS-15-2	kg	5-10	
Calcium magnesium hydroxide ($CaMg(OH)_4$)	kg	1,5-6	
Calcium magnesium hydroxide oxide ($CaMg(OH)_2O$)	kg	1,5-6	
Calcium hydroxide	kg	1-2	

PENETRON®

Materials / chemical substances	[Unit]	%	Environmental / hazardous properties
Cement, portland, chemicals	kg	50-70	No environmental or hazardous properties for all the product materials are present
Quartz	kg	0-50	
CTS-15-1	kg	3-37	

The list of PENETRON ADMIX® and PENETRON® components does not include products included in the “Candidate List of Substances of Very High Concern for Authorizations” by European Chemicals Agency (ECHA).

Recycled material

Provenience of recycled materials (pre-consumer or post-consumer) in the product: All PENETRON products components are virgin raw materials. No recycled materials are used.

Environmental performance

1kg of PENETRON ADMIX®

Potential environmental impact

PARAMETER		UNIT	A1	A2	A3	TOTAL A1-A3
Global warming potential (GWP)	Fossil	kg CO_2 eq.	1,16E+00	1,30E-02	1,25E-02	1,18E+00
	Biogenic	kg CO_2 eq.	9,69E-04	3,78E-06	2,69E-02	2,79E-02
	Land use and land transformation	kg CO_2 eq.	1,41E-04	3,80E-06	1,76E-05	1,63E-04
	TOTAL	kg CO_2 eq.	1,16E+00	1,30E-02	3,94E-02	1,21E+00
Depletion potential of the stratospheric ozone layer (ODP)		kg CFC 11 eq.	5,64E-08	2,36E-09	1,06E-09	5,98E-08
Acidification potential (AP)		kg SO_2 eq.	2,26E-03	4,62E-05	5,69E-05	2,36E-03
Eutrophication potential (EP)		kg PO_4^{3-} eq.	7,30E-04	9,59E-06	1,09E-04	8,49E-04
Formation potential of tropospheric ozone (POCP)		kg NMVOC	1,73E-03	5,19E-05	5,16E-05	1,83E-03
Abiotic depletion potential – Elements		kg Sb eq.	5,11E-07	3,83E-08	2,09E-08	5,70E-07
Abiotic depletion potential – Fossil resources		MJ, net calorific value	8,03E+00	1,94E-01	1,56E-01	8,38E+00
Water scarcity potential		m^3 eq.	9,67E-02	1,35E-03	8,04E-03	1,06E-01

Use of resources

PARAMETER		UNIT	A1	A2	A3	TOTAL A1-A3
Primary energy resources – Renewable	Use as energy carrier	MJ, net calorific value	2,31E-01	1,94E-03	3,39E-01	5,72E-01
	Used as raw materials	MJ, net calorific value	0,00E+00	0,00E+00	0,00E+00	0,00E+00
	TOTAL	MJ, net calorific value	2,31E-01	1,94E-03	3,39E-01	5,72E-01
Primary energy resources – Non-renewable	Use as energy carrier	MJ, net calorific value	9,12E+00	2,09E-01	2,02E-01	9,53E+00
	Used as raw materials	MJ, net calorific value	0,00E+00	0,00E+00	0,00E+00	0,00E+00
	TOTAL	MJ, net calorific value	9,12E+00	2,09E-01	2,02E-01	9,53E+00
Secondary material		kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Renewable secondary fuels		MJ, net calorific value	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Non-renewable secondary fuels		MJ, net calorific value	0,00E+00	0,00E+00	0,00E+00	0,00E+00

Net use of fresh water	m^3	2,61E-03	3,52E-05	2,23E-04	2,87E-03

Waste production and output flows

Waste production

PARAMETER	UNIT	A1	A2	A3	TOTAL A1-A3
Hazardous waste disposed	kg	4,57E-06	1,24E-07	2,94E-07	4,99E-06
Non-hazardous waste disposed	kg	1,93E-02	9,25E-03	1,62E-03	3,01E-02
Radioactive waste disposed	kg	3,13E-05	1,32E-06	6,91E-07	3,33E-05

Output flows

PARAMETER	UNIT	A1	A2	A3	TOTAL A1-A3
Components for reuse	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Material for recycling	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Materials for energy recovery	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Exported energy, electricity	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Exported energy, thermal	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00

Other environmental indicators

During the silo filling process, Noise corresponding to 60-80 dB is measured.

1 kg of PENETRON®
Potential environmental impact

PARAMETER		UNIT	A1	A2	A3	TOTAL A1-A3
Global warming potential (GWP)	Fossil	kg CO_2 eq.	7,04E-01	1,19E-02	1,16E-02	7,28E-01
	Biogenic	kg CO_2 eq.	1,50E-04	3,47E-06	9,60E-05	2,50E-04
	Land use and land transformation	kg CO_2 eq.	4,74E-05	3,49E-06	1,80E-05	6,89E-05
	TOTAL	kg CO_2 eq.	7,05E-01	1,19E-02	1,17E-02	7,28E-01
Depletion potential of the stratospheric ozone layer (ODP)		kg CFC 11 eq.	1,67E-08	2,16E-09	9,88E-10	1,99E-08
Acidification potential (AP)		kg SO_2 eq.	1,34E-03	4,24E-05	5,23E-05	1,44E-03
Eutrophication potential (EP)		kg PO_4^{3-} eq.	4,37E-04	8,81E-06	2,94E-05	4,76E-04
Formation potential of tropospheric ozone (POCP)		kg NMVOC	1,03E-03	4,76E-05	4,30E-05	1,12E-03
Abiotic depletion potential – Elements		kg Sb eq.	2,14E-07	3,52E-08	3,02E-08	2,79E-07
Abiotic depletion potential – Fossil resources		MJ, net calorific value	3,32E+00	1,78E-01	1,46E-01	3,65E+00
Water scarcity potential		m^3 eq.	6,01E-02	1,24E-03	8,05E-03	6,94E-02

Use of resources

PARAMETER		UNIT	A1	A2	A3	TOTAL A1-A3
Primary energy resources – Renewable	Use as energy carrier	MJ, net calorific value	1,10E-01	1,78E-03	3,38E-01	4,50E-01
	Used as raw materials	MJ, net calorific value	0,00E+00	0,00E+00	0,00E+00	0,00E+00
	TOTAL	MJ, net calorific value	1,10E-01	1,78E-03	3,38E-01	4,50E-01
Primary energy resources – Non-renewable	Use as energy carrier	MJ, net calorific value	3,82E+00	1,92E-01	1,86E-01	4,19E+00
	Used as raw materials	MJ, net calorific value	0,00E+00	0,00E+00	0,00E+00	0,00E+00
	TOTAL	MJ, net calorific value	3,82E+00	1,92E-01	1,86E-01	4,19E+00
Secondary material		kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Renewable secondary fuels		MJ, net calorific value	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Non-renewable secondary fuels		MJ, net calorific value	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Net use of fresh water		m^3	1,47E-03	3,23E-05	2,22E-04	1,72E-03

Waste production and output flows

Waste production

PARAMETER	UNIT	A1	A2	A3	TOTAL A1-A3
Hazardous waste disposed	kg	2,60E-06	1,14E-07	2,82E-07	3,00E-06
Non-hazardous waste disposed	kg	1,20E-02	8,50E-03	1,73E-03	2,23E-02
Radioactive waste disposed	kg	1,09E-05	1,22E-06	6,11E-07	1,27E-05

Output flows

PARAMETER	UNIT	A1	A2	A3	TOTAL A1-A3
Components for reuse	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Material for recycling	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Materials for energy recovery	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Exported energy, electricity	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Exported energy, thermal	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00

Other environmental indicators

During the silo filling process, Noise corresponding to 60-80 dB is measured.

References

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