Environmental Product Declaration

In accordance with ISO 14025 and EN 15804 for:

PENETRON Products for Indian Market

from

PENETRON https://www.penetron.com/ www.penetronproducts.in

Programme:	The International EPD® System, www.environdec.com
Programme operator:	EPD International AB
EPD registration number:	S-P-02177
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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:
PENETRON PRODUCTS PRIVATE LIMITED (PPPL)
No-24/22, Bhaktavatchalam street,
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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. Sited in Salem (India), the PENETRON PRODUCTS PRIVATE LIMITED (PPPL) produces a complete range of blending solutions and packaging alternatives from retail to bulk requirements. PPPL state-of-the-art blending equipment, lab & testing facilities aims to quickly take customer formula to production, thanks to the support of a highly experienced production team.

Name and location of production site: The EPD refers to the production of PENETRON Products, namely PENETRON ADMIX® and PENETRON® sold in the Indian market and produced in the manufacturing site, placed in Thoramangalam village, Salem – India, from base materials produced in the manufacturing site, placed in Allentown, Pennsylvania – USA.

Product information

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

Product identification: PENETRON products for Indian market

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® 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.

In order to reduce the sustainability impacts of the Penetron products for the Indian market, the production of PENETRON ADMIX® and PENETRON® is made starting by BASE products coming from the US production (in Allentown, PA), with the addition of local raw materials in Salem, India. Ingredients of BASE materials are supplied and transported to US 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 BASE products are ready to be packed in 1ton Polypropylene bags, moved by LGP forklift, palletized on wooden pallets, stretch wrap using a stretch film and put into stock via LGP forklift. 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.
BASE material are sent to India by ship and to Salem manufacturing site by truck. Additional materials, such as Quartz sand and Portland cement, are supplied and transported to Salem manufacturing site. Materials are moved next to the blender by air, by screw conveyors or by forklift. Polypropylene bags are sent via truck to a pollution approved vendor 200km away, who will reprocess them. The blender mixes all the raw materials by using electric energy. After blending, PENETRON products are ready to be packed. The product is added in 18kg or 22,7kg paper bags. It is, then, moved through conveyor belt and palletized on wooden pallets, some of them coming from the packaging of BASE materials. The product is stretched wrap using a stretch film and put into stock via diesel forklift. For all the manufacturing processes, dust is collected through a suction Dust Collector and, compressed air, used for seals, actuators and movement of raw materials, is generated through an Air Generator. Infrastructure, construction, production equipment, and tools that are not directly consumed in the production process are not been included in the system boundary.

UN CPC code: 375
Geographical scope: India

LCA information

Functional unit / declared unit: 1 kg of PENETRON product for the Indian market
Reference service life: Not Applicable
Time representativeness: Qualitative and quantitative information on the production of PENETRON products has been collected in October 2019-July 2020; quantitative data are related to the period July 2019-July 2020. All generic data refer to the Ecoinvent v3.6 database, including updated datasets
Database and LCA software used: ecoinvent v.3.6 and SimaPro v9.1. Ecoinvent data sets used for PENETRON products modelling have been updated within last 10 years.
System boundary: A1-A3 Modules
Description of system boundaries: Cradle-to-gate. The declared modules are identified in Figure 1 (MND=Module Not Declared) and a flow diagram describing the system boundary is provided in Figure 2.
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 Salem manufacturing site.

A3 Module includes all the activities/processes taking place in the Salem 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 of BASE products (amount of 10kg of paper waste for 1 ton of PENETRON product manufactured has been considered). The amount of kraft paper for final products bagging, pallets and packaging film for packaging have been estimated according to ecoinvent data “packing, lime product, Global”. Assumption of considering, for the base product packaging, the non-woven polypropylene textile instead of woven polypropylene textile (if only granulate polypropylene is used instead of non-woven polypropylene textile, the total difference in terms of Penetron products’ total environmental impacts is around 0,0001%). Assumption that the polypropylene bags carrying Penetron BASE products are sold once they are empty, therefore the transport to a pollution approved vendor is included. 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: Quantitative specific data are related to the period from July 2019 to July 2020. 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. During the Base materials production, 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. In the final materials production, no waste is produced since polypropylene bags are sent to a vendor to be reused. 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 v3.6 (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

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

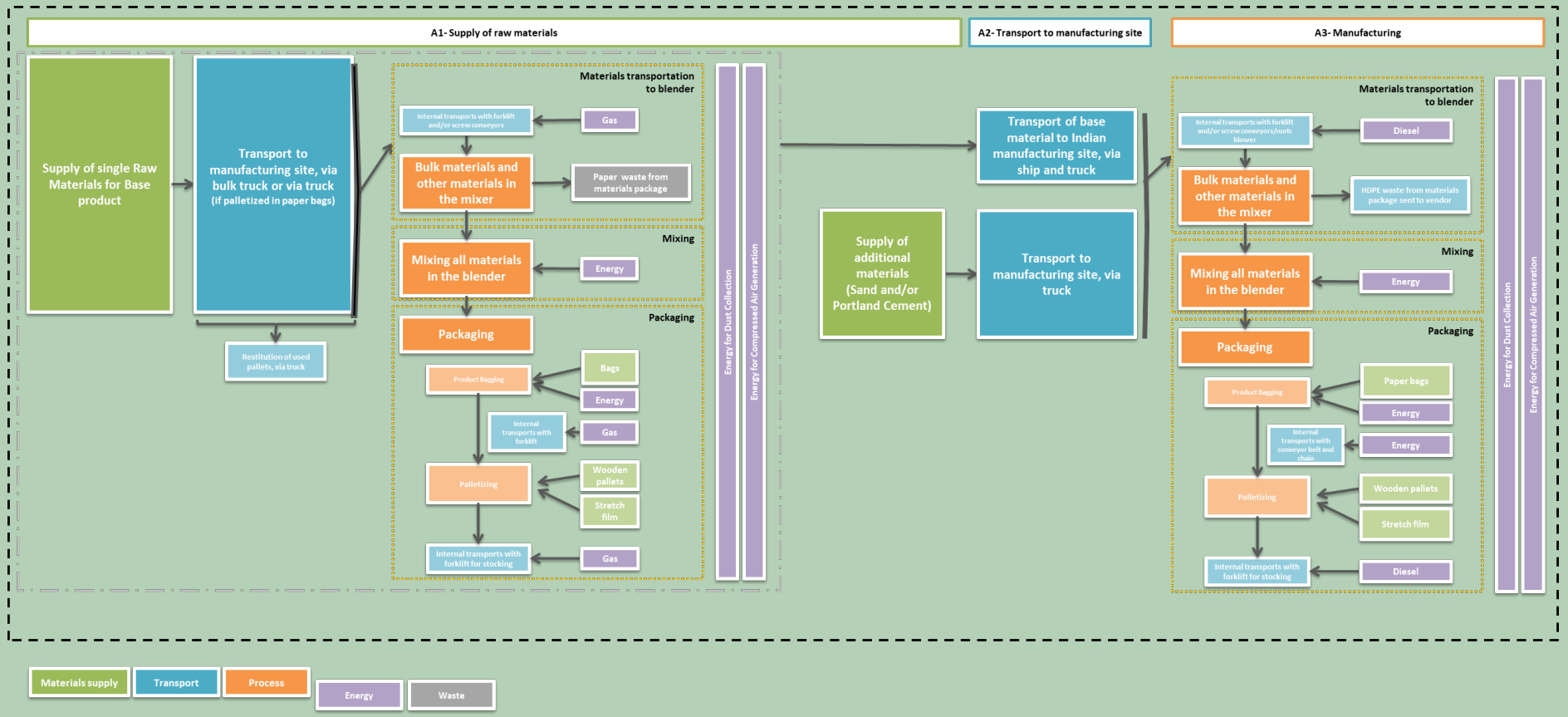

Figure 2: Flow diagram describing the PENETRON products system boundary

Content declaration

Product

PENETRON ADMIX®

Materials / chemical substances	[Unit]	%	Environmental / hazardous properties
Penetron ADMIX BASE	kg	20-40	No environmental or hazardous properties for all the product materials are present
Cement, portland, chemicals	kg	60-80	

The total ingredients of Penetron ADMIX and the respective percentages are the following:

Cement, portland, chemicals	*65% - 80%*
CTS-15-1	*10% - 30%*
CTS-15-2	*5% - 10%*
Calcium magnesium hydroxide ($CaMg(OH)_4$)	*1,5% - 6%*
Calcium magnesium hydroxide oxide ($CaMg(OH)_2O$)	*1,5% - 6%*
Calcium hydroxide	*1% - 2%*

PENETRON®

Materials / chemical substances	[Unit]	%	Environmental / hazardous properties
Penetron BASE	kg	10-30	No environmental or hazardous properties for all the product materials are present
Cement, portland, chemicals	kg	45-65	
Quartz	kg	20-40	

The total ingredients of Penetron and the respective percentages are the following:

Cement, portland, chemicals	*50% - 70%*
Quartz	*0% - 50%*
CTS-15-1	*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.	1,17E+00	1,01E-01	1,68E-02	1,29E+00
	Biogenic	kg CO_2 eq.	9,98E-03	3,05E-05	9,57E-05	1,01E-02
	Land use and land transformation	kg CO_2 eq.	1,32E-04	4,98E-05	1,59E-05	1,98E-04
	TOTAL	kg CO_2 eq.	1,18E+00	1,01E-01	1,69E-02	1,30E+00
Depletion potential of the stratospheric ozone layer (ODP)		kg CFC 11 eq.	5,93E-08	1,69E-08	9,59E-10	7,71E-08
Acidification potential (AP)		kg SO_2 eq.	2,94E-03	4,62E-05	7,91E-05	4,37E-03
Eutrophication potential (EP)		kg PO_4^{3-} eq.	8,66E-04	1,65E-04	3,47E-05	1,07E-03
Formation potential of tropospheric ozone (POCP)		kg NMVOC	2,50E-03	1,18E-03	6,49E-05	3,75E-03
Abiotic depletion potential – Elements		kg Sb eq.	8,50E-06	1,89E-06	1,28E-07	1,05E-05
Abiotic depletion potential – Fossil resources		MJ, net calorific value	9,21E+00	1,39E+00	2,09E-01	1,08E+01
Water scarcity potential		m^3 eq.	5,91E-02	3,78E-03	8,22E-03	7,11E-02

Use of resources

PARAMETER		UNIT	A1	A2	A3	TOTAL A1-A3
Primary energy resources – Renewable	Use as energy carrier	MJ, net calorific value	2,39E-01	1,34E-02	3,15E-01	5,68E-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	2,39E-01	1,34E-02	3,15E-01	5,68E-01
Primary energy resources – Non-renewable	Use as energy carrier	MJ, net calorific value	1,01E+01	1,50E+00	2,41E-01	1,19E+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	1,01E+01	1,50E+00	2,41E-01	1,19E+01
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	1,77E-03	1,25E-04	2,36E-04	2,13E-03

Waste production and output flows

Waste production

PARAMETER	UNIT	A1	A2	A3	TOTAL A1-A3
Hazardous waste disposed	kg	6,58E-06	2,82E-06	1,99E-07	9,59E-06
Non-hazardous waste disposed	kg	3,40E-02	4,32E-02	1,95E-03	7,91E-02
Radioactive waste disposed	kg	3,11E-05	9,46E-06	5,25E-07	4,11-05

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 around 70 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.	6,95E-01	7,44E-02	1,67E-02	7,86E-01
	Biogenic	kg CO_2 eq.	6,75E-05	2,30E-05	9,71E-05	1,88E-04
	Land use and land transformation	kg CO_2 eq.	3,24E-05	3,48E-05	1,72E-05	8,45E-05
	TOTAL	kg CO_2 eq.	6,95E-01	7,44E-02	1,68E-02	7,86E-01
Depletion potential of the stratospheric ozone layer (ODP)		kg CFC 11 eq.	1,51E-08	1,25E-08	9,58E-10	2,86E-08
Acidification potential (AP)		kg SO_2 eq.	1,84E-03	8,58E-04	7,91E-05	2,78E-03
Eutrophication potential (EP)		kg PO_4^{3-} eq.	5,37E-04	1,09E-04	3,50E-05	6,81E-04
Formation potential of tropospheric ozone (POCP)		kg NMVOC	1,61E-03	7,67E-04	6,50E-05	2,44E-03
Abiotic depletion potential – Elements		kg Sb eq.	1,42E-05	1,49E-06	1,50E-07	1,58E-05
Abiotic depletion potential – Fossil resources		MJ, net calorific value	3,98E+00	1,04E+00	2,08E-01	5,23E+00
Water scarcity potential		m^3 eq.	1,73E-02	2,95E-03	8,38E-03	2,86E-02

Use of resources

PARAMETER		UNIT	A1	A2	A3	TOTAL A1-A3
Primary energy resources – Renewable	Use as energy carrier	MJ, net calorific value	1,02E-01	1,03E-02	3,25E-01	4,38E-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	1,02E-01	1,03E-02	3,25E-01	4,38E-01
Primary energy resources – Non-renewable	Use as energy carrier	MJ, net calorific value	4,33E+00	1,11E+00	2,39E-01	5,68E+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	4,33E+00	1,11E+00	2,39E-01	5,68E+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	5,74E-04	9,75E-05	2,41E-04	9,12E-04

Waste production and output flows

Waste production

PARAMETER	UNIT	A1	A2	A3	TOTAL A1-A3
Hazardous waste disposed	kg	1,25E-06	2,22E-06	2,18E-07	3,69E-06
Non-hazardous waste disposed	kg	1,76E-02	3,55E-02	2,19E-03	5,53E-02
Radioactive waste disposed	kg	8,99E-06	7,01E-06	5,20E-07	1,65E-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 around 70 dB is measured.

References

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