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Hydraulic binder TEFRA 15

EPD Program Operator:

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Basic information

This declaration is the type III Environmental Product Declaration (EPD) based on EN 15804 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. Their aspects were verified by the independent body according to ISO 14025. Basically, a comparison or evaluation of EPD data is possible only if all the compared data were created according to EN 15804 (see point 5.3 of the standard).

Life cycle analysis (LCA): A1-A3 modules in accordance with EN 15804 (Cradle to Gate)

The year of preparing the EPD: 2021

Declared durability: Under normal conditions, hydraulic binder has reference service life (RSL) up to 30 years

Product standard: EN 14227-3:2013 Hydraulically bound mixtures – Specifications – Part 3:Fly ash bound granular mixtures; EN 14227-4:2013 Hydraulically bound mixtures – Specifications – Part 4:Fly ash for hydraulically bound mixtures

PCR: PCR A (PCR based on EN 15804)

Declared unit: 1 ton of the declared product TEFRA 15

Reasons for performing LCA: B2B

Representativeness: manufactured in Poland, 2020

Manufacturer and Product Information

EKOTECH Inżynieria Popiołów Sp. z o.o. produces and trades building materials such as road binders/adhesives, various road surfaces mixtures and fly ash aggregates for concrete. Hydraulic binder TEFRA 15 is produced in a linear process at the plant located in Konin (Poland).

TEFRA 15 is a hydraulic binder based on fly ash (co-product of electricity production). The product is dedicated for improvement of soil substrates, especially the cohesive soils serving as a reinforced base of a road and/or an embankment. The product is commercially available in form of grey and brown powders. The bulk density, tapped density and density of TEFRA 15 equals to 1,3 g/cm³, 1,6 g/cm³ and 2.64 g/cm³, respectively.

The addition of TEFRA 15 influences on:

- load capacity of the cohesive soils,
- land compaction,
- workability of the lands,
- serviceableness of the lands to stabilization with other binders.

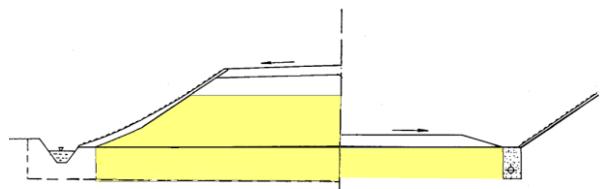


Fig. 1. The scheme illustrating an application of TEFRA 15

Moreover, in case of humid lands TEFRA 15 products:

- replaces lime for drying and stabilization,
- causes an increase in load capacity of cohesive soil,
- changes the structure of the land.

Depending on the type of soil, moisture content and the additional binders, the load generated on an improved stabilized TEFRA 15 substrate binder ranges from 60 to 150 MPa. The properties of the TEFRA 15 product are listed in Table 1. The material is intended for the improvement and stabilization of soil, mainly cohesive soils, which function as an improved substrate for a plot and/or an embankment.

Table 1. The properties of the TEFRA 15 product.

No	Features	Properties	Research methods
1.	Composition of the grains	90µm ≤ 30% masy	EM 451-2, PN-EN 933-10
2.	Stability of the volume	≤ 10 mm	PN-EN 196-3
3.	Content of the reactive calcium oxide	≥ 5%	PN-EN 197-1
4.	Content of the water	< 1%	PN-EN 14227-4
5.	Hydraulic activity	accord. to specification	PN-EN 197-1 Pkt. 5.2.4.3 The development of the strength after 7, 28 and 90 days

LIFE CYCLE ASSESSMENT (LCA) – general rules applied

Unit

1 ton of the declared product TEFRA 15

System boundary

The EPD covers the product stage analysis (“cradle to gate”). The product stage contains: Module A1: extraction and processing of raw materials (fly ash) and fuels, Module A2: transportation, Module A3: production (mixing). Inputs and processes of product system are presented in Figure 2.

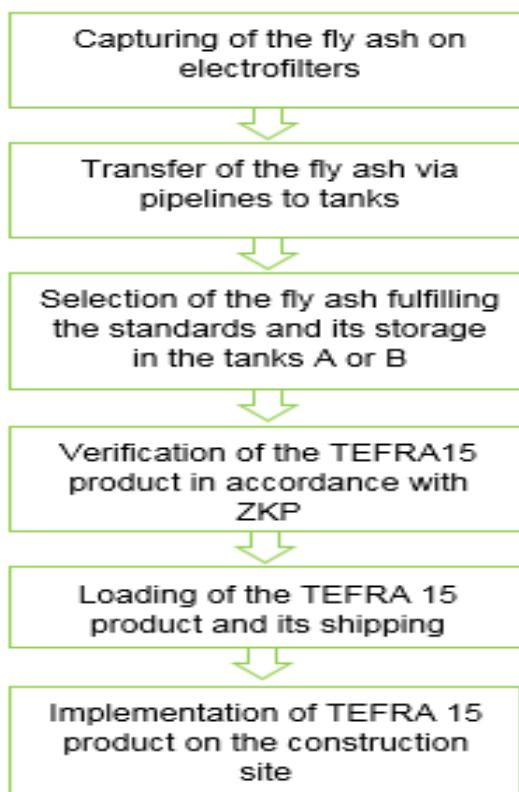


Fig. 2. The scheme of the production process of TEFRA15 in the factory in Konin (Poland), the view of the tanks A and B in the factory in Konin (Poland)

Allocation rules

The allocation rules used for this EPD are based on general requirements provided in ITB PCR A and EN 15804. The allocation is mass based. In the case of fly ash, a co-product from electricity production (Konin Plant) used as a cement constituent, economic allocation was applied. Emissions allocated in electricity production (module A1) are assessed using international methods for ETS system declaration (data based on Konin declarations). The specific prices for fly ash and electricity declared by the producer were used for the economic allocation.

System limits

In this assessment, all information gathered from data collection for the production has been modelled, i.e. all raw material used, the electrical energy, use of ancillary materials and all direct production waste. No cut-offs have been made in accordance with EN 15804. The machines and facilities (capital goods) required for and during production are excluded, as is transportation of employees.

A1 – A2 Modules: Raw materials supply and transport

Raw materials for the hydraulic binder TEFRA 15 production come from local a supplier - Zespół Elektrowni Pątnów - Adamów - Konin SA. The raw material is fly ash (co-product from the generation of electricity), which is the main product of hydraulic binder TEFRA 15. Means of transport include conveyors to mixers and tanks.

A3 Module Production

The Fig. 2 shows the production process of TEFRA 15 in the factory in Konin. The raw materials in a form of fly ashes are captured on electro filters and are transferred via pipelines to tanks. In the next step, fly ashes fulfilling the applicable standards are selected and are passed to the tanks A or B for storage. Then, TEFRA 15 is verified in accordance with the internal standards (ZKP), prepared for shipping and sent to a client. The implementation of the TEFRA 15 product takes place on the construction site.

Data collection period

The data for manufacture of the declared products refer to period between 01.01.2020 – 31.12.2020 (1 year). The life cycle assessments were done for Poland as reference area.

Data quality - production

The values determined to calculate A1-A3 originate from verified LCI inventory data. A1 values (raw materials) were prepared considering specific data from Konin plant (open source), Ecoinvent data and economic allocation data processed for ashes.

Assumptions and estimates

The impacts of the representative products were aggregated for Poland using weighted average. Due to the difficulty of separating the fly production processes from mixing A3, the data were aggregated as A1-A3.

Calculation rules

LCA was done in accordance with ITB PCR A document. Characterization factors are CML ver. 4.8 based. ITB-LCA algorithms were used for impact calculations.

Databases

The data for the processes come from the following sources: Ecoinvent 3.8. Characterization factors are CML ver. 4.2 based on EN 15804:2013+A1 version. (PN EN 15804+A1:2014-04). Specific (LCI) data quality analysis was a part of audit. The time related quality of the data used is valid (5 years).

Comparability

Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to EN 15804 and the building context, respectively the product-specific characteristics of performance, are taken into account. In practice, this means that concrete may be compared in a specific application with the selected usage scenario.

LIFE CYCLE ASSESSMENT (LCA) – Results

Declared unit

The declaration refers to the unit DU – 1 ton of Tefra 15. The LCA results for 1 ton are presented in the table 3.

Table 2. System boundaries (life stage modules included) in a product environmental assessment

Environmental assessment information (MA – Module assessed, MNA – Module not assessed, 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
MA	MA	MA	MNA	MNA	MNA	MNA	MNA	MNA	MNA	MNA	MNA	MNA	MNA	MNA	MNA	MNA

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Table 3. Environmental product characteristic – 1 ton of TEFRA 15.

Environmental impacts: (DU) 1 ton		
Indicator	Unit	Modules A1-A3
		TEFRA 15
Global warming potential (gross value)	kg eq CO ₂	21.34
Depletion potential of the stratospheric ozone layer	kg CFC 11	2.29E-10
Acidification potential of soil and water	kg SO ₂	0.088
Formation potential of tropospheric ozone	kg Ethene	0.064
Eutrophication potential	kg (PO ₄) ³⁻	0.0084
Abiotic depletion potential (ADP-elements) for non-fossil resources	kg Sb	0.0015
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	MJ	207.2
Environmental aspects: (DU) 1 ton		
Indicator	Unit	Modules A1-A3
		INA
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ	INA
Use of renewable primary energy resources used as raw materials	MJ	INA
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	31.05
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	INA
Use of non-renewable primary energy resources used as raw materials	MJ	INA
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	217.35
Use of secondary material	kg	0.0
Use of renewable secondary fuels	MJ	0.0
Use of non-renewable secondary fuels	MJ	0.0
Net use of fresh water	m ³	0.0038
Other environmental information describing waste categories: (DU) 1 ton		
Indicator	Unit	Modules A1-A3
		0.015
Hazardous waste disposed	kg	0.015
Non-hazardous waste disposed	kg	4.39
Radioactive waste disposed	kg	0.0
Components for re-use	kg	0.0
Materials for recycling	kg	0.0
Materials for energy recover	kg	0.0
Exported energy	MJ	0.0

RESULTS INTERPRETATION

The environmental impact of TEFRA 15 product is mainly dependent on the environmental footprint of fly ash as a co-product of electricity production (72% of A1-A3 impact). The rest of the impact depends on the energy use (electricity). The gross value of eq. CO₂ emissions (EN 15804/ISO 14067 based method) for assessed production is 21 kg of CO₂/ton TEFRA 15. Abiotic depletion potential (ADP-fossil fuels) for fossil resources is 207 MJ/ton.

VERIFICATION

The process of verification of this EPD was 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 15804:2012 and ITB PCR A	
Independent verification corresponding to ISO 14025 (subclause 8.1.3.)	
<input checked="" type="checkbox"/> external	<input type="checkbox"/> internal
External verification of EPD: Ph.D. Eng. Halina Prejzner LCA\LCI audit and input data verification: Ph.D. D.Sc. Eng. Michał Piasecki. m.piasecki@itb.pl Verification of LCA: Ph.D. Eng. Justyna Tomaszewska. j.tomaszewska@itb.pl	

The purpose of this EPD is to provide the basis for assessing buildings and other construction works. A comparison of EPD data is only meaningful if all the data sets compared were developed according to EN 15804 and the product-specific performance characteristics and its impacts on the construction works are taken into account.

Normative references

- ITB PCR A General Product Category Rules for Construction Products
- EN 14227-3:2013 Hydraulically bound mixtures – Specifications – Part 3: Fly ash bound granular mixtures;
- EN 14227-4:2013 Hydraulically bound mixtures – Specifications – Part 4: Fly ash for hydraulically bound mixtures
- EN 197-1:2011: Cement - part 1: Composition, specifications and conformity criteria for common cements
- PN-EN ISO 14025:2010 Environmental labels and declarations. Type III environmental declarations. Principles and procedures2.
- PN-EN 15804 Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products3.
- PN-EN 16908:2017-02 Cement and building lime. Environmental product declarations. Product category rules complementary to EN 158044.
- PN-EN ISO 14040:2009 Environmental management - Life cycle assessment - Principles and framework
- ECRA (European Cement Research Academy) – Background report “TR-ECRA 0181/2014 Environmental Product Declarations for representative European cements”
- KOBiZE, WSKAŹNIKI EMISYJNOŚCI CO₂, SO₂, NO_x, CO i pyłu całkowitego DLA ENERGII ELEKTRYCZNEJ na podstawie informacji zawartych w Krajowej bazie o emisjach gazów cieplarnianych i innych substancji za 2020 rok



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CERTIFICATE № 287/2021 of TYPE III ENVIRONMENTAL DECLARATION

Product:

Hydraulic binder TEFRA 15

Manufacturer:

EKOTECH Inżynieria Popiołów Sp. z o.o.

ul. Gen. S. Skalskiego 1/u16, 03-982 Warsaw, Poland

confirms the correctness of the data included in the development of
Type III Environmental Declaration and accordance with the requirements of the standard

PN EN 15804+A1

Sustainability of construction works.

Environmental product declarations.

Core rules for the product category of construction products.

This certificate, issued for the first time on 31st December 2021 is valid for 5 years
or until amendment of mentioned Environmental Declaration

Head of the Thermal Physics, Acoustics
and Environment Department

Agnieszka Winkler-Skalna, PhD



Deputy Director
for Research and Innovation

Krzysztof Kućzyński, PhD

Warsaw, December 2021