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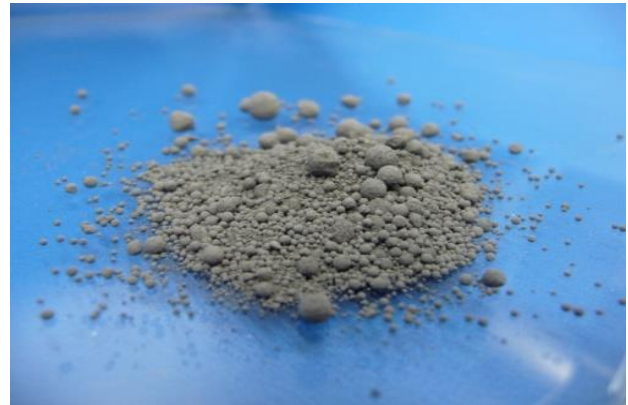
## Hydraulic binder TEFRA 25

### EPD Program Operator:

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### Owner of the EPD:

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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 13282-1:2013 Hydraulic road binders – Part 1: Rapid hardening hydraulic road binders – Composition, specification and conformity criteria

**PCR:** PCR A (PCR based on EN 15804)

**Declared unit:** 1 ton of the declared product TEFRA 25

**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.

The TEFRA 25 binding adhesive is design to improve the subgrade in civil engineering. The material is dedicated to stabilize and modify fine-grained land primarily consisting in improving geotechnical properties in order to increase their usefulness in civil engineering, and in particular in earthworks and improved surface.

TEFRA 25 binder provides:

- reduction of the degree of plasticity,
- drying of land,
- land compaction,
- increase in load capacity,
- resistance to water and frost.

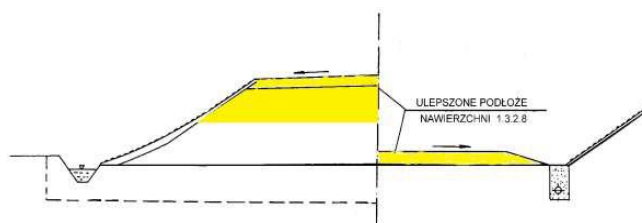


Fig. 1. The scheme illustrating an application of TEFRA 25

Beside, TEFRA 25 can be used as an enhancing material in grading land and aggregates as well as to stabilize the subsoil (Fig. 1.) with the strength requirements ( $R_m$  1.5 or 2.5 MPa), the layer of binder-stabilized material should obtain sufficient compressive strength and the required rate of frost resistance.

In addition TEFRA 25 influences on:

- increase in the compressive strength of road layers,
- reduction in material costs of the investment,
- improvement of land capacity factor.

The properties of the TEFRA 25 product are listed in Table 1.

Table 1. The properties of the TEFRA 25 product.

No	Features	Properties	Harmonised standard
1.	Compressive strength after 7 and 28 days	after 7 days $\geq 5,0$ MPa after 28 days $\geq 12,5 \leq 32,5$ MPa	PN-EN 13282-1:2013
2.	Degree of grinding, 90 $\mu$ m	$\leq 15\%$	
3.	Binding time: beginning of the binding	$\geq 90$ min	
4.	Stability of the volume	$\leq 10$ mm	
5.	Content of the sulfur	$< 4\%$	
6.	Composition of the binder	tolerance $\pm 10\%$ (m/m)* tolerance $\pm 5\%$ (m/m)**	

\*) - for the main component whose weight in the binder is over 20%

\*\*\*) - for the main component, the weight share in the binder is between 10 and 20%

The TEFRA 25 road bundle hydraulic group consists of 7 product types that differ in formulation, mainly ash content (minimum 60%).

## LIFE CYCLE ASSESSMENT (LCA) – general rules applied

### Unit

1 ton of the declared product TEFRA 25

### 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.

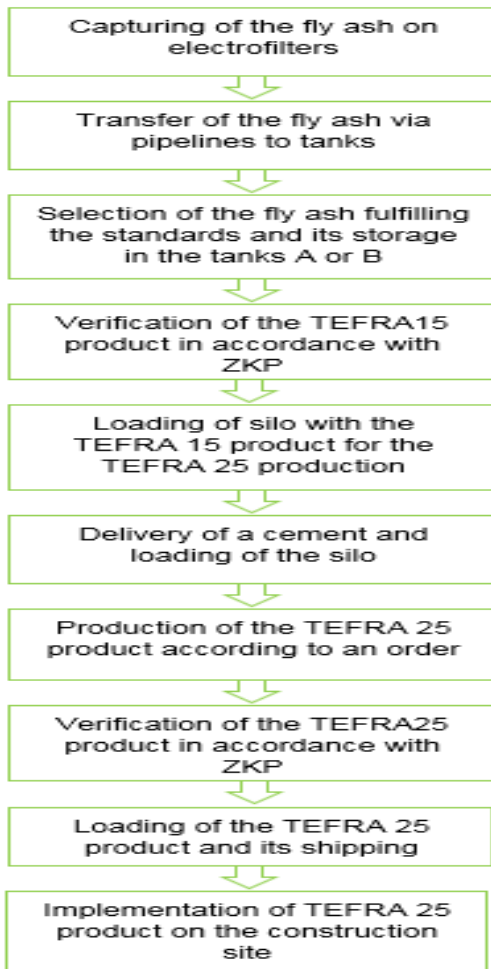


Fig. 2. The scheme of the production process of TEFRA 25 in the factory in Konin (Poland), the view of the tanks A and B in the factory in Konin (Poland)

### Allocation rules

The allocation rules used for this EPD are based on general requirements provided in ITB PCR A and EN 15804. The allocation between TEFRA 25 and other products 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 (CEM I and fly ash), 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 25 production come from local a supplier - Zespół Elektrowni Pątnów - Adamów - Konin SA. The raw materials are fly ash (co-product from the generation of electricity), which is the main product of hydraulic binder TEFRA 25 and CEM I 42.5 R. Means of transport include conveyors to mixers and tanks and CEM I transport (217 km).

### A3 Module Production

The Fig. 2 shows the production process of TEFRA 25 in the factory in Konin. The raw materials in the form of fly ashes are captured on electrofilters 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, a TEFRA 25 product is verified in accordance with the internal standards (ZKP) and loaded into a silo for production of the TEFRA 25 product by addition of CEM I 42,5 into the recipe. The production of the TEFRA 25 product is conducted in accordance with an order and the product is verified using the internal standards (ZKP).

### 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. CEM I data comes from national generic EPD for CEM I.

### 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. 4.8 based on EN 15804. 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.

## Environmental Product Declaration Type III ITB No. 288/2021

### LIFE CYCLE ASSESSMENT (LCA) – Results

#### Declared unit

The declaration refers to the unit DU – 1 ton of TEFRA 25. 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 25.

Environmental impacts: (DU) 1 ton		
Indicator	Unit	Modules A1-A3 TEFRA 25
Global warming potential (gross value)	kg eq CO <sub>2</sub>	351.4
Depletion potential of the stratospheric ozone layer	kg CFC 11	1.5E-09
Acidification potential of soil and water	kg SO <sub>2</sub>	0.38
Formation potential of tropospheric ozone	kg Ethene	0.32
Eutrophication potential	kg (PO <sub>4</sub> ) <sup>3-</sup>	0.048
Abiotic depletion potential (ADP-elements) for non-fossil resources	kg Sb	1.23E-03
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	MJ	1579.5
Environmental aspects: (DU) 1 ton		
Indicator	Unit	Modules A1-A3
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	236.9
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	1626,9
Use of secondary material	kg	29.4
Use of renewable secondary fuels	MJ	357.0
Use of non-renewable secondary fuels	MJ	511,5
Net use of fresh water	m <sup>3</sup>	3.44
Other environmental information describing waste categories: (DU) 1 ton		
Indicator	Unit	Modules A1-A3
Hazardous waste disposed	kg	0.05
Non-hazardous waste disposed	kg	10.68
Radioactive waste disposed	kg	0.0
Components for re-use	kg	0.0
Materials for recycling	kg	2.5E-07
Materials for energy recover	kg	0.0
Exported energy	MJ	0.0

### RESULTS INTERPRETATION

The environmental impact of TEFRA 25 product is mainly dependent on the environmental footprint of CEM I production (95% of A1-A3 impact). The rest of the impact depends on the energy use (electricity) and fly ash. The gross value of eq. CO<sub>2</sub> emissions (EN 15804/ISO 14067 based method) for assessed production is 351 kg of CO<sub>2</sub>/ton TEFRA 25. Abiotic depletion potential (ADP-fossil fuels) for fossil resources is 1579 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 13282-1:2013 Hydraulic road binders – Part 1: Rapid hardening hydraulic road binders – Composition, specification and conformity criteria
- 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 procedures<sup>2</sup>.
- PN-EN 15804 Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products<sup>3</sup>.
- PN-EN 16908:2017-02 Cement and building lime. Environmental product declarations. Product category rules complementary to EN 15804.
- 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 CO<sub>2</sub>, SO<sub>2</sub>, NO<sub>x</sub>, 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 No 288/2021 of TYPE III ENVIRONMENTAL DECLARATION

Product:

**Hydraulic binder TEFRA 25**

Manufacturer:

**EKOTECH Inżynieria Popiołów Sp. z o.o.**

ul. Gen. S. Skalskiego 1/u16, 03-982 Warszawa, 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 31<sup>st</sup> December 2021 is valid for 5 years  
or until amendment of mentioned Environmental Declaration

Head of the Thermal Physic, Acoustics  
and Environment Department

  
Agnieszka Winkler-Skalna, PhD



Deputy Director  
for Research and Innovation

  
Krzysztof Kućzyński, PhD

Warsaw, December 2021