

ENVIRONMENTAL PRODUCT DECLARATION

in accordance with ISO 14025 and EN 15804:2012+A2:2019



Hard Aggregates

AEIFOROS Metal Processing S.A.

Programme

The International
EPD® System,
www.environdec.com

Programme operator

EPD International AB

EPD registration number

S-P-04181

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Programme

The International
EPD® System



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EPD Based on Product Category Rules (PCR)

The CEN standard EN 15804 serves as the core Product Category Rules (PCR)
PCR 2019:14 Construction products (EN 15804:A2); Version 1.1; 2020-09-14.

PCR review was conducted by

The Technical Committee of the International EPD® System.

Independent third-party verification of the declaration and data, according to ISO 14025:2006

EPD process certification EPD verification

Third party verifier:

Procedure for follow-up 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 programs may not be comparable. EPDs of construction products may not be comparable if they do not comply with EN 15804. For further information about comparability, see EN 15804 and ISO 14025.

Company information

AEIFOROS S.A., a company of **VIOHALCO GROUP**, was established in 2001, initially for the recycling of steel manufacturing by-products, and expanded since then providing a wide range of solutions for the processing of industrial byproducts, aiming at the valorization of those valuable secondary resources. Through circularity and industrial symbiosis, AEIFOROS contributes to the supply of more than 400.000 tons of secondary materials annually, to the saving of natural resources and the sustainability of the industry.

The company operates two production plants in Greece, one located in Almyros with privately-owned port facilities, and one in Thessaloniki. In 2004 AEIFOROS established a subsidiary company in Bulgaria AEIFOROS BULGARIA S.A. involved in similar activities.

Committed to operate always with absolute responsibility and respect for the Environment and the Society, AEIFOROS has published and implements strict ESG policies, while plant management systems are certified according to ISO 9001:2015, 14001:2015 and 45001:2018.

The main services and products of the company are the following:

Production of aggregates from steel slags in quality and fractions according to the intended application, including hard aggregates certified acc. to EN 13043, heavy aggregates for dense concrete applications certified acc. to EN 12620, aggregates for unbound applications certified acc. to EN 13242

Production of secondary raw materials and alternative fuels for industrial use

Integrated management of shredder residues and scrap sorting residues

Recovery and valorization of scrap metals

Industrial waste management and services for the transboundary shipment of wastes

Electric Arc Furnace (EAF) Slag is a steel-manufacturing byproduct, which after suitable processing, constitutes an excellent hard aggregate for the manufacturing of asphalt layers in the road construction industry, especially for the antiskid top layer on highways and motorways, contributing to the construction of a safer road network. The use of EAF hard aggregates, a recovered secondary material, fits into circular economy principles and green procurement practices.

AEIFOROS introduced the production of slag aggregates in Greece and was the first company to certify hard aggregates acc. to EN 13043 in the country.

The hard aggregates are manufactured in two plants of AEIFOROS S.A (Thessaloniki and Almyros) under strict ISO 9001 certified quality system, in grain sizes meeting road construction national standards; they are certified according to EN 13043 or EN 13242 depending on the application.

The main advantage of EAF slag aggregates is the excellent mechanical properties that satisfy domestic specifications for incorporation into bituminous mixtures for skid resistant layers and surface treatments. The asphalt layer resulting has increased lifetime, improved road safety features and contributes to the protection of the environment since less natural aggregates are used and landscape is preserved from quarrying while secondary materials are valorized.

The production process consists of a series of dry mechanical processes, such as sorting for the removal of large pieces, iron magnetic separation, primary and secondary crushings and screening for the production of the final products in the desired fractions. The aggregates produced are stored in piles on site.



Product information

Analytically processing includes the following mechanical processes:

IN ALMYROS

First stage:

Primary crushing and metallic iron separation by magnet

Second stage:

Secondary crushings, magnetic separation of metallic iron residues, screening into final fractions.

IN THESSALONIKI

First stage:

Sorting, primary screening and metallic iron separation by magnet

Second stage:

Successive crushings, magnetic separation of metallic iron residues, screening into final fractions.

The properties of the products included in the study are presented below:

Properties	Characteristics	Performance	Technical specification
Physical properties	Bulk density (Mg/m ³)	1,6	EN 1097-6
	Density on dry material (Mg/m ³)	3,3	EN 1097-6
	Water absorption	WA ₂₄ 2	EN 1097-5
Chemical properties	Chemical composition	FeO 31-62%	EN 1744-1
		CaO 26-53%	
		SiO ₂ 9-25%	
		MnO 5-10%	
Mechanical properties	Resistance to wear (micro-Deval)	MDE10	
	Resistance to fragmentation (Los Angeles)	LA15	EN 1097-1
	Resistance to polishing	PSV62	EN 1097-2
	Resistance to surface abrasion	AAV10	EN 1097-8
	MgSO ₄ soundness/ Resistance to freezing and thawing	MS18	EN 1097-8



AEIFOROS Hard aggregates can be produced in a variety of fractions depending on the final screen size:

Thessaloniki plant



Hard aggregate products

Gravel Category A (4/12 mm)

Gravel Category B (6,3/10 mm)

Gravel Category C (10/16 mm)

Crushed Sand (0/6 mm)

Almyros plant



Hard aggregate products

Category A (4/12 mm)

Category C (10/16 mm)

Crushed Sand (0/5 mm)

This is a specific EPD and covers hard aggregates produced in Almyros plant and Thessaloniki plant in Greece.

The product does not contain any substances listed in the "Candidate List of Substances of Very High Concern (SVHC) for authorization" exceeding 0.1 % of the weight of the product.



DECLARED UNIT

The declared unit is 1 tonne of hard aggregates.



GOAL AND SCOPE

This EPD evaluates the environmental impacts of the production of 1 tonne of products from Cradle-to-gate (A1-A3), produced in two different plants, Almyros and Thessaloniki.



CUT-OFF RULES

According to PCR 2019:14, where there is insufficient data for a unit process, the cut-off criteria are 1% of the total mass of input of that process and the total of neglected input flows per module is a maximum of 5% of energy usage and mass.



BACKGROUND DATA

The most recent version of Ecoinvent database (V3.8) was used as a source of background data.



SOFTWARE

The software used for the production of the LCA results is OpenLCA 1.10.3.



DATA QUALITY

Data on raw materials, transportation of materials and products along with energy and water consumption in manufacturing stage was collected by Aeiforos. Regarding electricity mix, the latest (2020) national residual electricity mix as published in DAPEEP SA was utilized.



TIME REPRESENTATIVENESS

All primary data used in this study is for the entire year 2021.



GEOGRAPHICAL SCOPE

Worldwide



ASSUMPTIONS

For road transportation a lorry 16-32 metric ton, EURO4 was used.



CPC CODE

3931 Slag, dross, scalings and other waste from the manufacture of iron or steel.



ALLOCATIONS

Allocations in the LCA datasets used are documented accordingly in the datasets by Ecoinvent. Concerning the manufacturing stage, when needed, an allocation based on the mass of the products and co-products, such as aggregates for other uses, from the site has been applied.

X=included, MND=Module Not Declared																	
	Product stage			Construction stage		Use stage							End of life stage			Resource recovery stage	
	Raw Materials Supply	Transport	Manufacturing	Transport	Construction installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction and demolition	Transport	Waste processing for reuse, recovery and/or recycling	Disposal	Reuse-Recovery-Recycling-potential
Module	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Modules declared	X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND
Geography	GR	EU	GR														
Specific data used	>90%			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation-products	Not relevant			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation-sites	Not relevant			-	-	-	-	-	-	-	-	-	-	-	-	-	-



A1: Raw Material Supply

The production starts with the material supply (A1). This stage includes the generation of electricity and fuels required for the manufacturing and the recycling process of secondary materials. The only raw material used is EAF slag, which is a secondary material derived from steel industries.



A2: Transportation of raw materials to manufacturer

Transportation is relevant for delivery of raw materials from the supplier to the gate of manufacturing plant (A2). The supplier of slag is nearby to the manufacturing plant, approximately 1.5 km for Almyros plant and 0,6 km for Thessaloniki plant, minimizing the impacts of the transportation.



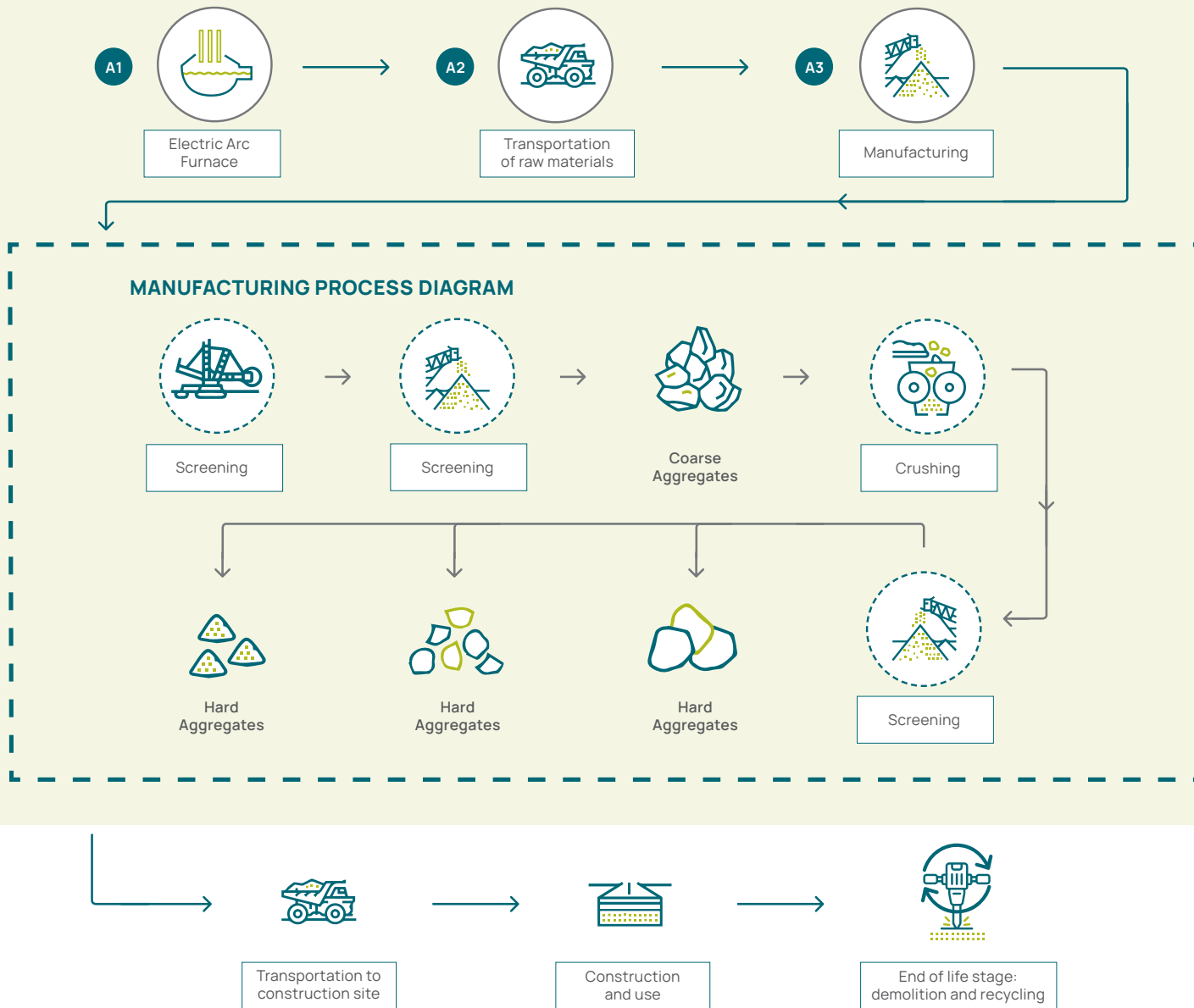
A3: Manufacturing

Manufacturing of the products includes all the processes required for the production of aggregates (A3), such as the screening and crushing of the slag.

Deconstruction and demolition of the products (C1), transportation of the discarded product (C2), re-use or recycling (C3), disposal (C4) and avoided burdens (D) will be omitted from the study, since aggregates fulfill all three of the conditions below, according to EN 15804-2012+A2 2019:

- the product or material is physically integrated with other products during installation so they cannot be physically separated from them at end of life, and
- the product or material is no longer identifiable at end of life as a result of a physical or chemical transformation process, and
- the product or material does not contain biogenic carbon.

System boundary



ENVIRONMENTAL IMPACTS

Parameter	Unit	A1-A3
Global Warming Potential-total	kg CO2 eq	4,38E+00
Global Warming Potential-fossil	kg CO2 eq	4,36E+00
Global Warming Potential-biogenic	kg CO2 eq	9,18E-03
Global Warming Potential-luluc	kg CO2 eq	3,78E-03
Global Warming Potential-GHG ¹	kg CO2 eq	4,33E+00
Ozone Depletion Potential	kg CFC-11 eq	6,16E-07
Acidification Potential	mol H+ eq	1,78E-02
Eutrophication Potential-freshwater	kg PO4-3 eq	1,10E-02
Eutrophication Potential-freshwater ²	kg P eq	3,60E-03
Eutrophication Potential-marine	kg N eq	3,00E-03
Eutrophication Potential-terrestrial	mol N eq	2,51E-02
Photochemical Oxidation	kg NMVOC eq	7,75E-03
Abiotic Depletion Potential-non fossil resources	kg Sb eq	5,69E-06
Abiotic Depletion Potential-fossil resources	MJ	7,09E+01
Water use ³	m ³ eq	1,34E+00

¹ This indicator includes all greenhouse gases included in GWP-total but excludes biogenic carbon dioxide emissions and uptake and biogenic carbon stored in the product with characterization factors (CFs) based on IPCC (2013).

² Eutrophication aquatic freshwater shall be given in both kg PO4-3 eq and kg P eq.

³ The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experience with the indicator.



Environmental performance of 1 tonne of aggregates

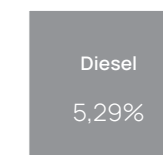
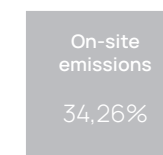
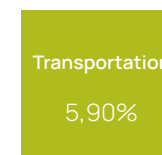
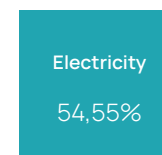
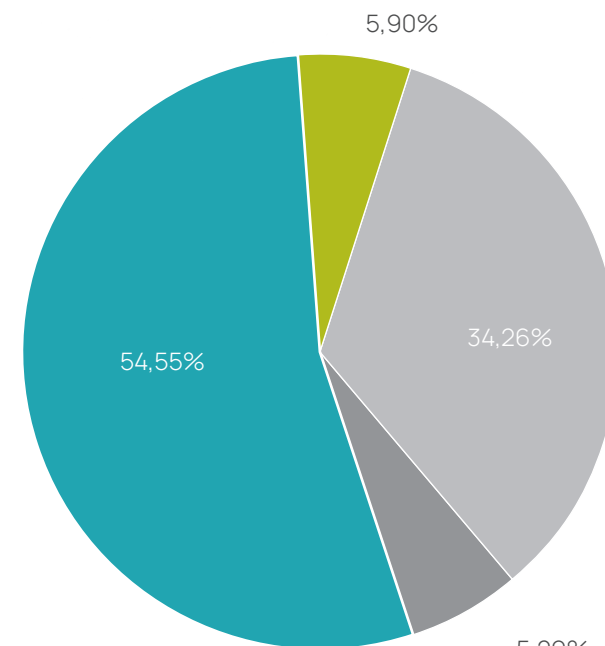
OUTPUT FLOWS AND WASTE CATEGORIES

Parameter	Unit	A1-A3
Hazardous waste disposed	kg	9,21E-05
Non-hazardous waste disposed	kg	3,48E-01
Radioactive waste disposed	kg	4,29E-04
Components for re-use	kg	0,00E+00
Materials for recycling	kg	0,00E+00
Materials for energy recovery	kg	0,00E+00
Exported energy	MJ	0,00E+00

RESOURCE USE

Parameter	Unit	A1-A3
Use of renewable primary energy excluding resources used as raw materials	MJ	6,86E+00
Use of renewable primary energy resources used as raw materials	MJ	0,00E+00
Total use of renewable primary energy resources	MJ	6,86E+00
Use of non-renewable primary energy excluding resources used as raw materials	MJ	7,09E+01
Use of non-renewable primary energy resources used as raw materials	MJ	0,00E+00
Total use of non-renewable primary energy resources	MJ	7,09E+01
Use of secondary material	kg	1,00E+03
Use of renewable secondary fuels	MJ	0,00E+00
Use of non-renewable secondary fuels	MJ	0,00E+00
Use of net fresh water	m ³	0,00E+00

Almyros 2021 GWP-TOTAL



Additional information

The EPD does not give information on release of dangerous substances to soil, water and indoor air because the horizontal standards on measurement of release of regulated dangerous substances from construction products using harmonized test methods according to the provisions of the respective technical committees for European product standards are not available.

ENVIRONMENTAL IMPACTS

Parameter	Unit	A1-A3
Global Warming Potential-total	kg CO2 eq	5,67E+00
Global Warming Potential-fossil	kg CO2 eq	5,65E+00
Global Warming Potential-biogenic	kg CO2 eq	1,60E-02
Global Warming Potential-luluc	kg CO2 eq	6,51E-03
Global Warming Potential-GHG ¹	kg CO2 eq	5,60E+00
Ozone Depletion Potential	kg CFC-11 eq	5,95E-07
Acidification Potential	mol H+ eq	2,69E-02
Eutrophication Potential-freshwater	kg PO4-3 eq	1,95E-02
Eutrophication Potential-freshwater ²	kg P eq	6,36E-03
Eutrophication Potential-marine	kg N eq	4,36E-03
Eutrophication Potential-terrestrial	mol N eq	3,40E-02
Photochemical Oxidation	kg NMVOC eq	1,02E-02
Abiotic Depletion Potential-non fossil resources	kg Sb eq	8,58E-06
Abiotic Depletion Potential-fossil resources	MJ	9,55E+01
Water use ³	m ³ eq	2,34E+00

¹ This indicator includes all greenhouse gases included in GWP-total but excludes biogenic carbon dioxide emissions and uptake and biogenic carbon stored in the product with characterization factors (CFs) based on IPCC (2013).

² Eutrophication aquatic freshwater shall be given in both kg PO4-3 eq and kg P eq.

³ The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experience with the indicator.



Environmental performance of 1 tonne of aggregates

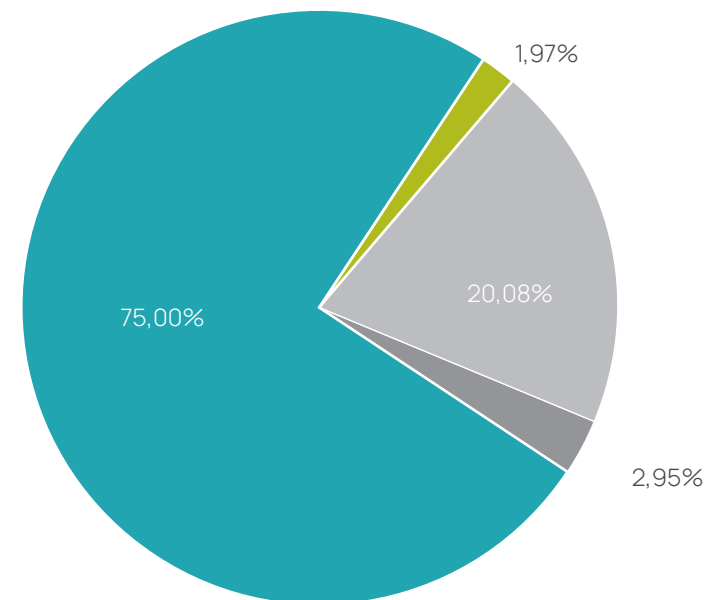
OUTPUT FLOWS AND WASTE CATEGORIES

Parameter	Unit	A1-A3
Hazardous waste disposed	kg	8,26E-05
Non-hazardous waste disposed	kg	3,34E-01
Radioactive waste disposed	kg	5,49E-04
Components for re-use	kg	0,00E+00
Materials for recycling	kg	0,00E+00
Materials for energy recovery	kg	0,00E+00
Exported energy	MJ	0,00E+00

RESOURCE USE

Parameter	Unit	A1-A3
Use of renewable primary energy excluding resources used as raw materials	MJ	1,21E+01
Use of renewable primary energy resources used as raw materials	MJ	0,00E+00
Total use of renewable primary energy resources	MJ	1,21E+01
Use of non-renewable primary energy excluding resources used as raw materials	MJ	9,55E+01
Use of non-renewable primary energy resources used as raw materials	MJ	0,00E+00
Total use of non-renewable primary energy resources	MJ	9,55E+01
Use of secondary material	kg	1,00E+03
Use of renewable secondary fuels	MJ	0,00E+00
Use of non-renewable secondary fuels	MJ	0,00E+00
Use of net fresh water	m ³	6,99E-05

Thessaloniki 2021
GWP-TOTAL



Electricity

75,00%

Transportation

1,97%

On-site emissions

20,08%

Diesel

2,95%

Additional information

The EPD does not give information on release of dangerous substances to soil, water and indoor air because the horizontal standards on measurement of release of regulated dangerous substances from construction products using harmonized test methods according to the provisions of the respective technical committees for European product standards are not available.

- **General Programme Instructions**

of the International EPD® System. Version 3.01, 2019-09-18

- **PCR 2019:14**

v.1.11 Construction products. EPD System. Date 2021-02-05. Valid until 2024-12-20

- **EN 15804:2012+A2:2019**

Sustainability of construction works - Environmental Product Declarations - Core rules for the product category of construction products

- **ISO 14020:2000**

Environmental labels and declarations – General principles

- **ISO 14025:2006**

Environmental labels and declarations - Type III environmental declarations - Principles and procedures

- **ISO 14040:2006**

Environmental management - Life cycle assessment-Principles and framework

- **ISO 14044:2006**

Environmental management - Life cycle assessment - Requirements and guidelines

- **Ecoinvent / Ecoinvent Centre**

www.Eco-invent.org

- **Residual Energy Mix 2020**

from Renewable Energy Sources Operator & Guarantees of Origin (DAPEEP SA)



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