Environmental Product Declaration

In accordance with ISO 14025:2006 and EN 15804:2012+A2:2019/AC:2021 for:

Paval®

from

Befesa Aluminio S.L

Programme:	The International EPD System, www.environdec.com
Programme operator:	EPD International AB
Licensee:	-
Type of EPD:	EPD of a single product from a manufacturer/service provider
EPD registration number:	EPD-IES-0026120:001
Version date:	2025-11-13
Validity date:	2030-11-13
	An EPD may be updated or depublished if conditions change. To find the latest version of the EPD and to confirm its validity, see www.environdec.com

GENERAL INFORMATION

Programme Information	
Programme:	The International EPD® System
Address:	EPD International AB Box 210 60 SE-100 31 Stockholm Sweden
Website:	www.environdec.com
E-mail:	support@environdec.com

Product Category Rules (PCR)
CEN standard EN 15804 serves as the Core Product Category Rules (PCR)
Product Category Rules (PCR): PCR 2019:14 Construction Product. VERSION 2.0.1
PCR review was conducted by: **The Technical Committee of the International EPD System. A full list of members is available on www.environdec.com. The review panel may be contacted via support@environdec.com** **Chairs of the PCR review: Rob Rouwette (chair), Noa Meron (co-chair)**
c-PCR, if applicable: N/A

Third-party Verification
Independent third-party verification of the declaration and data, according to ISO 14025:2006, via: ☒ **Individual EPD verification without a pre-verified LCA/EPD tool** Certification body: Certinalia S.L.U. Address: Anardi 5 – 20730 Azpeitia (Gipuzkoa), Spain info@certinalia.com Accredited by: ENAC Certification number: 125/C-PR365 Auditor: Eva Larzabal
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 published in different EPD programmes, may not be comparable. For two EPDs to be comparable, they shall be based on the same PCR (including the same first-digit version number) or be based on fully aligned PCRs or versions of PCRs; cover products with identical functions, technical performances and use (e.g. identical declared/functional units); have identical scope in terms of included life-cycle stages (unless the excluded life-cycle stage is demonstrated to be insignificant); apply identical impact assessment methods (including the same version of characterisation factors); and be valid at the time of comparison.
For further information about comparability, see EN 15804 and ISO 14025.

INFORMATION ABOUT EPD OWNER

Owner of the EPD: Befesa Aluminio S.L
Address: Ctra. de Cabezón, s/n, Valladolid, Spain
Contact: Mario Vivero Puras (mario.vivero@befesa.com)

Address and contact information of the LCA practitioner commissioned by the EPD owner, if applicable:
IK ingeniería
Av. Cervantes 51,Edif. 10, panta 5, dpto.
48970 Basauri, Bizkaia (Spain)

Description of the organisation:
Befesa Aluminio S.L focused in aluminium salt slag recycling services is divided into three services that carry out different but highly complementary activities:

- Recycling services for salt slag, Spent Pot Lining (SPL), used refractories and other waste.
- Processing services for secondary smelting aluminium alloys from scrap and waste containing metal to produce customised alloys.
- Technology and sale of specialised machinery.

The scope of the Befesa Aluminio CT Valladolid plant is the “Recycling, recovery and valorisation of waste from primary and secondary aluminium production”.

Product-related or management system-related certifications:
EMAS-registrations
Certifications: ISO (9001, 14001, 14064, 50001), ISO 45001

PRODUCT INFORMATION

Product name: Paval®

Product identification:
Paval® is essentially a powder of inorganic oxides, mainly alumina, grey in colour and with a particle size of less than 150 microns. The product has REACH registration number: 01-2120931274-59-0001. This product is used industrial applications, having an especial role in the clinker industry as an aluminium corrector, and also as an input for the production of rockwool, ceramic, etc. Paval is a product obtained from a process of the treatment of salt slag and SPL, and can be used as an alternative to aluminum oxides from the primary aluminum industry.

Visual representation (e.g., an image) of the product

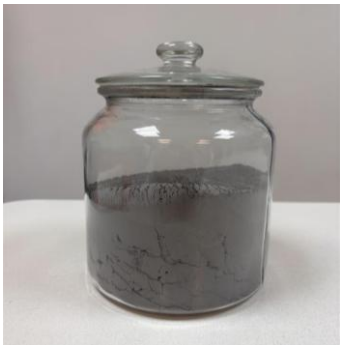

Figure 1. *Paval®*

UN CPC code: CPC 41432, alumina (aluminium oxide), except artificial corundum.

Product description:
The composition of Paval® and its physical and chemical properties are shown in the following tables:

Table 1. Composition of the Paval®.

CAS number	CE number	CE name	Molecular formula	% of weight	Classification number CE/1272/2008
1344-28-1	215-691-6	Aluminium Oxide	Al_2O_3	62.1	Unclassified
12068-51-8	235-100-5	Aluminium Spinels	($MgAl_2O_4$, …)	15.5	Unclassified
21645-51-2	244-492-7	Aluminium Hydroxide	$Al(OH)_3$	14.7	Unclassified
7631-86-9	231-545-4	Silicon Dioxide	SiO_2	4.2	Unclassified
1309-48-4	215-171-9	Magnesium Oxide	MgO	3.5	Unclassified

Table 2. Physical and chemical properties of Paval®.

Appearance	Dark grey powder
Odour	Slight smell of ammonia in fresh material, which disappears over time.
pH (at 100 g/l, 20ºC)	9 - 12
Boiling point	Not applicable
Melting point	1,440ºC
Absolute density	2.6 g/cm3
Solubility in water (20ºC)	Negligible
Flammability (solid, gas)	Non-flammable
Explosive properties	None
Oxidising properties	None

The main uses and applications of Paval® are:

- Manufacture of Clinker cement (cement industry)
- Manufacture of ceramic and refractory products (ceramic industry)
- Manufacture of thermal and acoustic insulation
- Manufacture of products for blast furnace deoxidation (steel industry)

Given that its main use is in the construction industry, it has been decided to select the PCR for construction materials as a basis.

Name and location of production site(s):
Befesa Aluminio CT Valladolid (Ctra. de Cabezón, s/n, Valladolid, Spain)

Website:
For more information: www.befesa.com

Description of manufacturing:
The Paval® manufacturing process takes place at the Valladolid production plant, where the recycling process of salt slag and SPL is made. Salt slag is waste from secondary aluminium smelting processes. It is produced when salts are used to cover molten material, mainly from low-quality aluminium scrap and aluminium-rich slag. SPL, on the other hand, comes from primary aluminium production.

The recycling process of salt slag and SPL consists mainly of three main stages: an initial stage of mechanical treatment using physical processes, followed by a chemical reaction process for the hazardous components, and finally, a physical decanting and filtration process.

Paval® is obtained after the third stage, in the warehouse, after a drying process. From this point onwards, it is no longer considered waste and becomes a marketable product, as it meets the four conditions for end-of-waste state set out in PCR 2019:14 Construction products.

According to the PCR, the end-of-waste state is reached when all the following criteria are fulfilled (adopted from EN 15804):

- the recovered material, component or product is commonly used for specific purposes;
- a market or demand, identified, e.g., by a positive economic value, exists for such a recovered material, component, or product;
- the recovered material, component or product fulfils the technical requirements for the specific purposes and meets the existing legislation and standards applicable to products; and
- the use of the recovered material, product or construction element will not lead to overall adverse environmental or human health impacts.

El Paval® fulfils these four conditions at the end of the drying process because:

1. The product only can be used with a moisture content of 15-18%. Humidity over that percentage makes the product not useful. This moisture content is achieved after the natural drying stage in the warehouse (dry Paval®).
2. At this point, it is ready for sale, as it has reached the appropriate moisture content and temperature for sale.
3. At this point, it also complies with the technical specifications set by customers.
4. The product does not present any risk to the environment or human health, as stated in its technical data sheet and REACH regulations.

After the natural drying, Paval® is loaded onto a lorry using a loading shovel for delivery to the customer. Therefore, the stages of the production process that would be included in the study, in accordance with the end-of-waste conditions, would be this last one. For more information, see the process diagram in LCA information.

CONTENT DECLARATION

- The mass (weight) of one unit of a product, as purchased or per declared unit: 1 kg of Paval®.

Product content	Mass, kg	Post-consumer recycled material, mass-% of product	Biogenic material, mass-% of product	Biogenic material, kg C/product or declared unit
Aluminium oxide (recovered from the treatment of salt slag)	1.00	100.0%	0.00	0.00
TOTAL	**1.00**	**100.0%**	**0.00**	**0.00**

Packaging materials	Mass, kg	Mass-% (versus the product)	Biogenic material, kg C/product or declared unit
N/A	0.00	0.00	0.00
TOTAL	**0.00**	**0.00**	**0.00**

1 kg biogenic carbon in the product/packaging is equivalent to the uptake of 44/12 kg of CO_2.

Hazardous substances from the candidate list of SVHC	EC No.	CAS No.	Mass-% per product or declared unit
N/A	N/A	N/A	N/A

LCA INFORMATION

Declared unit:
The declared unit is the baseline reference for which all information is collected. In this study, the declared unit is **"1 kg of Paval®".**

Reference service life:
Not relevant for this EPD.

Time representativeness:
The data collection from factory (primary data) is from 2024-10-01 to 2025-09-30.
In this study, no datasets older than 10 years were used.

Geographical scope:
The geographical scope of this EPD is European.

Database(s) and LCA software used:
Ecoinvent 3.11 database
SimaPro v10.2.0.0. software

EPD/LCA Tool used: N/A

Description of system boundaries:
According to the standard UNE-EN 15804:2012+A2:2019/AC:2021 and PCR 2019:14 Construction products (version 2.0.1) the system boundary is cradle to gate (modules A1-A3). The end-of-life phase (module C) has been excluded as the following four criteria defined in PCR 2019:14 (V2.0.1) are achieved:

- the product or material is physically integrated with other products during installation so they cannot be physically separated from them at end of life
- the product or material is no longer identifiable at end of life as a result of a physical or chemical transformation process
- the product or material does not contain biogenic carbon
- the EPD is not intended to be used for business-to-consumer communication

The life cycle stages A4-A5, B1-B7 were excluded from the LCA study.

Process flow diagram:
According to the description of the manufacturing process in product information, the process flow diagram corresponding to module A1-A3 is the following:

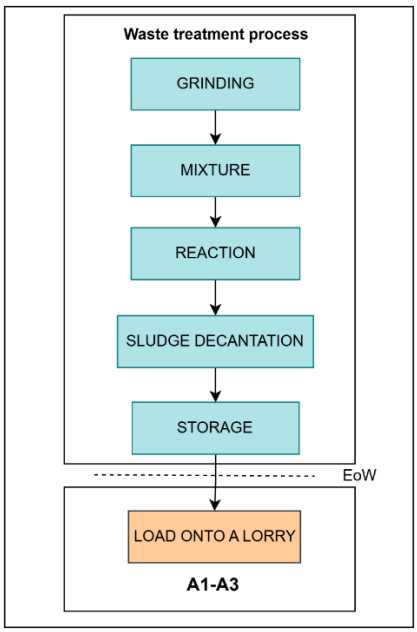

Figure 2. Process diagram flow of Paval®

More information:

Data quality

The environmental impact of Paval® has been calculated. It is based on the international standards established for the development of environmental product declarations, such as ISO 14025 for the preparation of the environmental product declaration, ISO 14040 and ISO 14044 for the preparation of the life cycle analysis, UNE-EN 15804:2012+A2:2019/AC:2021 and the Product Category Rules (PCR 2019:14 Construction products (version 2.0.1).

Data has been collected from 2024-10-01 to 2025-09-30 and is representative of a full year. Data for raw material supply, transport to fabrication plant and production (A1-A3) is based on specific consumption data for the Valladolid factory. Regarding modules A1 and A2, although they are applicable, they do not include input and output flows, as the raw material inputs are waste that is treated until it reaches its end-of-waste status.

Declaration of data sources, reference years, data categories, and share of primary data:

Process	Source type	Source	Reference year	Data category	Share of primary data, of GWP-GHG results for A1-A3
Manufacturing of product (Fuel consumption of the loading shovel)	Collected data	EPD owner	October 2024 – September 2025	Primary data	100%

SimaPro v10.2.0.0. software was used to prepare the life cycle analysis together with the Ecoinvent 3.11 database. Characterization factors from EN15804: 2012 + A2:2019. The geographical coverage is global. Technological coverage is typical or average.

The processes associated with fuel production are intrinsically included in the indicators in ECOINVENT's database used in carrying out the LCA.

The time horizon of validity granted to the data collected is one year, covering the period from 2024-10-01 to 2025-09-30.

Assumptions

- ✓ The calculation of the diesel consumption has been made using direct measurements taken by the company during the period from August to September 2025. It has been extrapolated to the entire period as it is the most conservative approach. Secondary calculations, using a whole one-year period were made, but the consumptions obtained with those calculations were lower than the obtained from the direct measurement + extrapolation, so the most conservative results were adopted.

Exclusions

The Life Cycle Inventory does not include:

- ✓ The manufacturing processes of the capital goods or spare parts and/or maintenance with a life of more than three years.
- ✓ The environmental impact of infrastructure for general management, office, and headquarters operations.
- ✓ The impact caused by people (common activities, travel for work...).
- ✓ The consumption of natural gas for sanitary hot water from showers and heating system for the comfort of people.

Cut-off rules

The standard ISO 14025 and the PCR -"2019:14 CONSTRUCTION PRODUCTS (version 2.0.1)" indicate that the life cycle inventory data should include a minimum of 95% of the total inputs (materials and energy) for each stage. No cut-off rules have been applied in this study.

Allocations

The product is obtained after the treatment process of a waste. The allocation of the treatment waste follows the cut-off method. The impacts before the waste reaches its End-of-Waste state are allocated to the treatment of the waste. Impacts after the EoW state are allocated to Paval®.

Modules declared, geographical scope, share of primary data (in GWP-GHG results) and data variation (in GWP-GHG results):

	Product stage			Distribution/ installation stage		Use stage							End-of-life stage				Beyond product life cycle
	Raw material supply	Transport	Manufacturing	Transport	Construction installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	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	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Geography	EU	EU	EU	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Share of primary data	>90%			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation – products	Not applicable			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation – sites	Not applicable			-	-	-	-	-	-	-	-	-	-	-	-	-	-

"X" modules declared
ND: Not declared

The share of primary data is calculated based on GWP-GHG results. It is a simplified indicator for data quality that supports the use of more primary data, to increase the representativeness of and comparability between EPDs. Note that the indicator does not capture all relevant aspects of data quality and is not comparable across product categories.

The share of primary data is >90% because there is only one input in this study (fuel consumption of loading shovel). That input is operated directly by the company and is located within module A3.

ENVIRONMENTAL PERFORMANCE

LCA results of the product(s) - main environmental performance results

Mandatory impact category indicators according to EN 15804

Results per functional or declared unit		
Indicator	**Unit**	**A1-A3**
GWP-total	kg CO_2 eq.	1.44E-03
GWP-fossil	kg CO_2 eq.	1.44E-03
GWP-biogenic	kg CO_2 eq.	1.60E-07
GWP-luluc	kg CO_2 eq.	1.47E-07
ODP	kg CFC 11 eq.	2.14E-11
AP	mol H^+ eq.	1.29E-05
EP-freshwater	kg P eq.	5.03E-09
EP-marine	kg N eq.	5.98E-06
EP-terrestrial	mol N eq.	6.55E-05
POCP	kg NMVOC eq.	1.96E-05
ADP-minerals&metals[1]	kg Sb eq.	5.13E-10
ADP-fossil[1]	MJ	1.87E-02
WDP[1]	m^3	4.00E-05
Acronyms	GWP-fossil = Global Warming Potential fossil fuels; GWP-biogenic = Global Warming Potential biogenic; GWP-luluc = Global Warming Potential land use and land use change; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential, Accumulated Exceedance; EP-freshwater = Eutrophication potential, fraction of nutrients reaching freshwater end compartment; EP-marine = Eutrophication potential, fraction of nutrients reaching marine end compartment; EP-terrestrial = Eutrophication potential, Accumulated Exceedance; POCP = Formation potential of tropospheric ozone; ADP-minerals&metals = Abiotic depletion potential for non-fossil resources; ADP-fossil = Abiotic depletion for fossil resources potential; WDP = Water (user) deprivation potential, deprivation-weighted water consumption	

Disclaimers:
The estimated impact results are only relative statements, which do not indicate the endpoints of the impact categories, exceeding threshold values, safety margins and/or risks.

[1] 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 experienced with the indicator.

Additional mandatory and voluntary impact category indicators

Results per functional or declared unit		
Indicator	**Unit**	**A1-A3**
GWP-GHG[2]	kg CO_2 eq.	1.44E-03
Particulate matter emissions (PM)	Disease incidence	3.67E-10
Ionizing radiation, human health (IRP)[3]	kBq U235 eq.	3.11E-06
Eco-toxicity - freshwater (ETP-fw)[4]	CTUe	1.02E-03
Human toxicity, cancer effect (HTP-c)[4]	CTUh	1.46E-13
Human toxicity, non-cancer effects (HTP-nc)[4]	CTUh	2.30E-12
Land use related impacts/Soil quality (SQP)[4]	dimensionless	1.24E-03

Resource use indicators

Results per functional or declared unit		
Indicator	**Unit**	**A1-A3**
PERE	MJ	1.15E-04
PERM	MJ	0.00E+00
PERT	MJ	1.15E-04
PENRE	MJ	1.87E-02
PENRM	MJ	0.00E+00
PENRT	MJ	1.87E-02
SM	kg	1.00E+00
RSF	MJ	0.00E+00
NRSF	MJ	0.00E+00
FW	m^3	1.32E-06
Acronyms	PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used as raw materials; PENRT = Total use of non-renewable primary energy re-sources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water	

[2] This indicator accounts for all greenhouse gases except biogenic carbon dioxide uptake and emissions and biogenic carbon stored in the product. As such, the indicator is identical to GWP-total except that the CF for biogenic CO_2 is set to zero.

[3] This impact category deals mainly with the eventual impact of low dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator.

[4] 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 experienced with the indicator.

Waste indicators

Results per functional or declared unit		
Indicator	**Unit**	**A1-A3**
Hazardous waste disposed	kg	1.30E-07
Non-hazardous waste disposed	kg	1.27E-05
Radioactive waste disposed	kg	1.96E-09

Output flow indicators

Results per functional or declared unit		
Indicator	**Unit**	**A1-A3**
Components for re-use	kg	0.00E+00
Material for recycling	kg	0.00E+00
Materials for energy recovery	kg	0.00E+00
Exported energy, electricity	MJ	0.00E+00
Exported energy, thermal	MJ	0.00E+00

Information on biogenic carbon content

Results per functional or declared unit		
Biogenic carbon content	**Unit**	**Quantity**
Biogenic carbon in product	kg C	0.00E+00
Biogenic carbon in packaging	kg C	0.00E+00

Note: 1 kg biogenic carbon is equivalent to 44/12 kg CO_2.

ABBREVIATIONS

Abbreviation	Definition
General Abbreviations	
EN	European Norm (Standard)
GPI	General Programme Instructions
ISO	International Organization for Standardization
CEN	European Committee for Standardization
CPC	Central product classification
EC	European Community
CAS	Chemical Abstracts Service
SVHC	Substances of Very High Concern
ND	Not Declared
EU	European
EoW	End of Waste
SPL	Spent Pot Lining
GWP-fossil	Global Warming Potential fossil fuels
GWP-biogenic	Global Warming Potential biogenic
GWP-luluc	Global Warming Potential land use and land use change
ODP	Depletion potential of the stratospheric ozone layer
AP	Acidification potential, Accumulated Exceedance
EP-freshwater	Eutrophication potential, fraction of nutrients reaching freshwater end compartment
EP-marine	Eutrophication potential, fraction of nutrients reaching marine end compartment
EP-terrestrial	Eutrophication potential, Accumulated Exceedance
POCP	Formation potential of tropospheric ozone
ADP-minerals&metals	Abiotic depletion potential for non-fossil resources
ADP-fossil	Abiotic depletion for fossil resources potential
WDP	Water (user) deprivation potential, deprivation-weighted water consumption
PERE	Use of renewable primary energy excluding renewable primary energy resources used as raw materials
PERM	Use of renewable primary energy resources used as raw materials
PERT	Total use of renewable primary energy resources
PENRE	Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials
PENRM	Use of non-renewable primary energy resources used as raw materials
PENRT	Total use of non-renewable primary energy re-sources
SM	Use of secondary material
RSF	Use of renewable secondary fuels
NRSF	Use of non-renewable secondary fuels
FW	Use of net fresh water

REFERENCES

a) General Programme Instructions of International EPD® System. Version 5.0.1.
b) PCR 2019:14. Construction Products. Version 2.0.1
c) EN 15804:2012+A2:2019 Sustainability of construction works-Environmental Product Declarations-Core rules for the product category of construction products
d) ISO 14020:2000 Environmental labels and declarations-General principles.
e) ISO 14025:2010 Environmental labels and declarations-Type III Environmental Declarations-Principles and procedures.
f) ISO 14040:2006/A1:2020 Environmental Management-Life Cycle Assessment-Principles and framework.
g) ISO 14044:2006/A2:2021 Environmental Management-Life Cycle Assessment-Requirements and guidelines.

VERSION HISTORY

Original Version of the EPD, 2025-11-13

VERIFICATION STATEMENT CERTIFICATE

CERTIFICADO DE DECLARACIÓN DE VERIFICACIÓN

Certificate No. / Certificado nº: EPD14001

CERTINALIA, S.L.U., confirms that independent third-party verification has been conducted of the Environmental Product Declaration (EPD) on behalf of:
CERTINALIA, S.L.U., confirma que se ha realizado verificación de tercera parte independiente de la Declaración Ambiental de Producto (DAP) en nombre de:

BEFESA ALUMINIO, S.L.U.
Carretera de Cabezón s/n
47011 VALLADOLID - SPAIN

for the following product:
para el siguiente producto:

PAVAL®

with registration number **EPD-IES-0026120** in the International EPD® System *(www.environdec.com)*
*con número de registro **EPD-IES-0026120** en el Sistema International EPD® (www.environdec.com)*

it´s in conformity with:
es conforme con:

- **ISO 14025:2010 Environmental labels and declarations. Type III environmental declarations.**
- **General Programme Instructions for the International EPD® System v5.**
- **PCR 2019:14 Construction products (EN 15804:A2) version 2.0.**
- **UN CPC 41432 Alumina (aluminium oxide), except artificial corundum.**

Issued date / *Fecha de emisión:*	11/11/2025
Update date / *Fecha de actualización:*	11/11/2025
Serial Nº / *Nº Serie:*	EPD1400100-E

Carlos Nazabal Alsua
Manager

The validity of this certificate is subject to the validity of its related EPD.
La validez de este certificado está sujeta a la vigencia de su correspondiente EPD.

This certificate is subject to modifications, temporary suspensions and withdrawals by CERTINALIA.
El presente certificado está sujeto a modificaciones, suspensiones temporales y retiradas por CERTINALIA.

The validity of this certificate can be checked through consultation in www.certinalia.com.
El estado de vigencia del certificado puede confirmarse mediante consulta en www.certinalia.com.

ENAC
CERTIFICACIÓN
ISO 17065
Nº125 / C-PR283

EPD
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