Environmental Product Declaration

In accordance with ISO14025:2006 and EN15804:2012+A2:2019

ERGODYN 31 E/ AUSTROGEL P/ POLADYN 31 Eco/ CENTRIC 2000/ CENTRIC MAGNASPLIT/ MINEX ECO

Owner of the declaration:
NITROERG S.A.

Product name:
ERGODYN 31 E/ AUSTROGEL P/ POLADYN 31 Eco/ CENTRIC 2000/ CENTRIC MAGNASPLIT/ MINEX ECO

Declared unit:
1 kg of manufactured, installed and used (detonated) packaged explosives product

Product category /PCR:
[NPCR 024 version 2.0 Explosives and Initiation Systems, ver.2.0 (11/2021)]

Program holder and publisher:
The Norwegian EPD foundation

Declaration number:
NEPD-9418-9023

Registration number:
NEPD-9418-9023

Issue date: 20.03.2025

Valid to: 20.03.2030

The Norwegian
EPD Foundation

General information

Product:
Packaged explosives: Ergodyn 31 E/
AUSTROGEL P/ POLADYN 31 Eco/
CENTRIC 2000/ CENTRIC MAGNASPLIT/
MINEX ECO

Program operator:
The Norwegian EPD Foundation
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Declaration number:
NEPD-9418-902

This declaration is based on Product Category Rules:
NPCR 024 version 2.0 Explosives and Initiation Systems, ver.2.0 (11/2021

Statement of liability:
The owner of the declaration shall be liable for the underlying information and evidence. EPD Norway shall not be liable with respect to manufacturer, life cycle assessment data and evidences.

Declared unit:
1 kg of manufactured, installed and used (detonated) packaged explosives product

Declared unit with option:
A1-A3, A4, A5

Functional unit:
1 kg

Verification:
Independent verification of the declaration and data, according to ISO14025:2010

internal ☐ external ■

Sign

Kristine Bjørdal

Independent verifier approved by EPD Norway

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Management system:
ISO 9001, ISO 14001

Organisation no:
EU VAT: PL6462746961

Issue date:
20.03.2025

Valid to:
20.03.2030

Year of study:
LCA conducted in 2023. Production inventory data has been collected for 2021.

Comparability:
EPD of construction products may not be able to compare if they do not comply with EN 15804 and are seen in a building context.

The EPD has been worked out by:
Mineral and Energy Economy Research Institute Polish Academy of Sciences

Approved

Manager of EPD Norway

Product

Product description:

Ergodyn 31 E/ AUSTROGEL P/ POLADYN 31 Eco/ CENTRIC 2000/ CENTRIC MAGNASPLIT/ MINEX ECO (henceforth referred as Ergodyn 31 E) is a nitroester explosive designed for use in underground and open-pit mining operations asexplosive for rock blasting applications. It cannot be used in conditions of coal dust and/or methane explosion hazards. It can be loaded into dry and wet blastholes. Table below shows properties of the product as well as packaging and conditions of storage and use.

Product specification:

Materials	%
Ammonium nitrate	62- 66
Glyceryl trinitrate / Ethylene glycol dinitrate	29 - 33
Nitrocellulose	0.3 - 2
Carbonaceous additives	3.5 – 8.5

Properties	Unit	Value
Oxygen balance	[%]	4,72
Heat of explosion	[kJ/kg]	4 027
Energy concentration	[kJ/dm^3]	5 648
Volume of gaseous products of explosion	[dm^3/kg]	887
Specific energy	[kJ/kg]	965
Consistency	-	ductile
Density	[g/cm^3]	1,50±0,10
Detonation velocity (Ø 50 mm cartridge)	[m/s]	> 4 500
Detonation velocity (Ø 32 mm steel pipe)	[m/s]	5 500

Conditions of storage and use	Value
Storage temperature	od 0^{0}C do 30^{0}C
Use temperature	od -20^{0}C do 50^{0}C
Shelf life	12 months (in paper and foil wrappers) 18 months (in plastic tubes)

Technical data:

1 kg explosives product

EC-type Certificate: ERGODYN 31 E (1453.EXP.15.0222); AUSTROGEL P (1453.EXP.10.0177); POLADYN 31Eco (0589.EXP.0601/99); CENTRIC 2000, CENTRIC MAGNASPLIT (1453.EXP.10.0176); MINEX ECO (PVTT 099/02).

Reference service life, building:

Not relevant. Explosives cannot be used more than once

LCA: Calculation rules

Declared unit:

1 kg of manufactured, installed and used (detonated) packaged explosives product

Cut-off criteria:

Cut-off criteria: All major raw materials and all the essential energy is included.

Allocation:

The allocation is made in accordance with the provisions of EN 15804. Allocation procedures were applied to co-products, materials, packaging materials and energy inputs, as well as to production outputs.

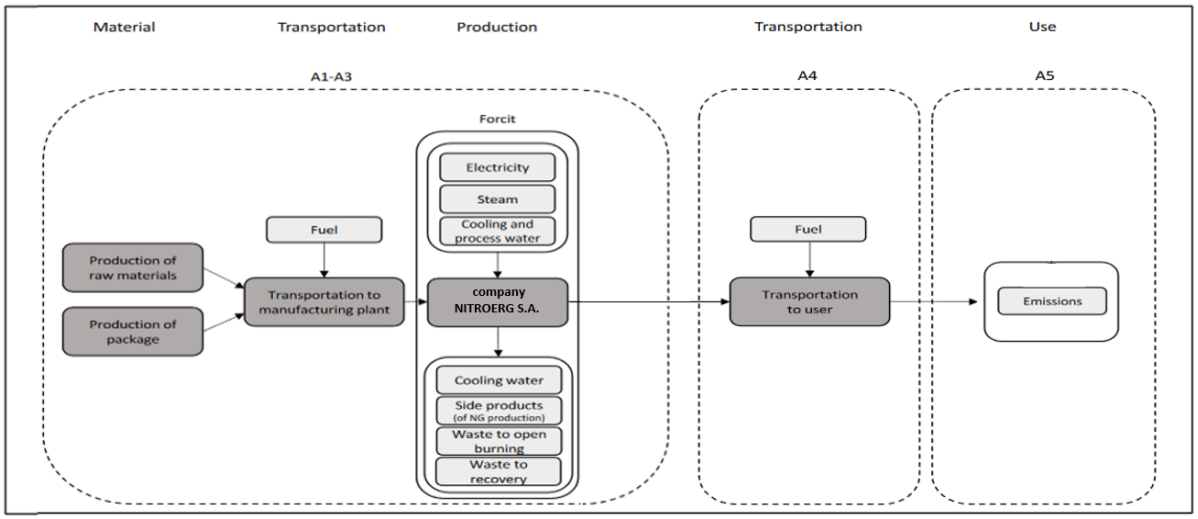
Data quality:

Data has been collected in 2021 and is represetative of that year. Data for production, transport and storage of explosives (A1-A3) is based on specific consumption data for the factory at Bieruń in Poland. Detonation of explosives has been calculated from a balanced chemical reaction, at final state and 1 bar (T = 273 K; p = 1013 hPa). Calculations are based on generic data for upstream processes and manufacturer's specific and average data for product manufacture stage. Generic data is from ecoinvent v3.9, Allocation, Cut-Off by classification (May 2024) SimaPro. Characterization factors from EN15804:2012+A2:2019..

System boundaries (X=included, MNR=module not relevant, MNR=module not relevant)

Product stage			Assembly stage		Use stage							End of life stage				Benefits & loads beyond system boundary
Raw materials	Transport	Manufacturing	Transport	Detonation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction 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
X	X	X	X	X	MNR	MNR	MNR	MNR	MNR	MNR	MNR	MNR	MNR	MNR	MNR	MNR

System boundary:



The diagram illustrates the life cycle stages of a product, focusing on Nitroerg's operations. The production stage (A1-A3) encompasses the supply of raw materials, transportation of these inputs to the manufacturing facility, and the production process, including the synthesis of nitroglycerin, blending, and the formation of explosive products, supported by significant energy and resource inputs. The construction and installation stage (A4-A5) covers the transportation of finished products to end users, such as mining or industrial sites, and their use.

LCA: Scenarios and additional technical information

The following information describe the scenarios in the different modules of the EPD.

Transport from production place to assembly/user (A4)

Transport from production place to assembly/user (A4)	Capacity utilisation (incl. return) %	Distance (km)	Fuel/Energy consumption	Unit	Value
Truck	50	2000	-	tkm	2

Transport to the customer is carried out at an average distance of 2000 km by a 7.5-16 tonne Euro 6 truck.

Detonation of explosives (A5)

	Unit	Value
Water consumption	m3	0
Electricity consumption	kWh	0
Other energy carriers	MJ	0
Material loss	kg	1
Output materials from waste treatment	kg	0
Emissions to air:		

CO_2	g	208,61
H_2O	g	375,66
N_2	g	292,04
O_2	g	112,32
Others	g	11,37

Theoretical calculations per kg explosive product detonated, from a balanced chemical reaction, at final state and 1 bar.

Waste treatment of packaging products is included in calculation.

LCA: Results

The LCA results are presented below for the declared unit defined on page 2 of the EPD document. Impact assessment results are presented with core and additional impact indicators presented in EN15804+A2. Reading example: 9,0 E-03 = 9,0*10-3 = 0,009

Core environmental impact indicators

Indicator	Unit	A1-A3	A4	A5
GWP - total	kg CO2 eq	1,46E+00	3,89E-01	2,49E-01
GWP - fossil	kg CO2 eq	1,51E+00	3,89E-01	2,38E-01
GWP - biogenic	kg CO2 eq	-5,64E-02	5,96E-05	1,10E-02
GWP - luluc	kg CO2 eq	3,80E-03	1,47E-05	2,65E-08

Core environmental impact indicators (continued)

Indicator	Unit	A1-A3	A4	A5
ODP	kg CFC11 eq	5,04E-08	5,67E-09	2,30E-13
AP	molc H+ eq	8,40E-03	6,06E-04	2,30E-13
EP- freshwater	kg P eq	6,44E-05	8,98E-07	3,89E-07
EP -marine	kg N eq	1,45E-03	1,40E-04	1,80E-04
EP - terrestrial	molc N eq	2,85E-02	1,41E-03	1,97E-03
POCP	kg NMVOC eq	4,04E-03	8,64E-04	6,63E-04
ADP-M&M[2]	kg Sb-Eq	3,95E-07	2,29E-08	3,58E-11
ADP-fossil[2]	MJ	2,32E+01	5,17E+00	2,19E-04
WDP[2]	m^3	6,43E-01	7,18E-03	6,94E-06

GWP-total: *Global Warming Potential;* ***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; See "additional Norwegian requirements" for indicator given as PO4 eq.* ***EP-marine:*** *Eutrophication potential, fraction of nutrients reaching freshwater end compartment;* ***EP-terrestrial:*** *Eutrophication potential, Accumulated Exceedance;* ***POCP****: Formation potential of tropospheric ozone;* ***ADP-M&M****: Abiotic depletion potential for non-fossil resources (minerals and metals);* ***ADP-fossil:*** *Abiotic depletion potential for fossil resources;* ***WDP:*** *Water deprivation potential, deprivation weighted water consumption.*

Reading example: 9,0 E-03 = 9,0*10-3 = 0,009

Additional environmental impact indicators

Indicator	Unit	A1-A3	A4	A5
PM	Disease incidence	6,09E-08	1,96E-08	0,00E+00
IRP[1]	kBq U235 eq.	2,08E-02	5,10E-04	0,00E+00
ETP-fw[2]	CTUe	3,28E+00	1,92E+00	0,00E+00
HTP-c[2]	CTUh	2,36E-10	2,49E-11	0,00E+00
HTP-nc[2]	CTUh	6,26E-09	2,39E-09	0,00E+00
SQP[2]	Dimensionless	1,65E+01	1,95E-02	0,00E+00

PM: *Particulate matter emissions;* ***IRP:*** *Ionising radiation, human health;* ***ETP-fw:*** *Ecotoxicity (freshwater);* ***ETP-c:*** *Human toxicity, cancer effects;* ***HTP-nc:*** *Human toxicity, non-cancer effects;* ***SQP:*** *Land use related impacts / soil quality*

[1] 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.

[2] 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

Resource use

Parameter	Unit	A1-A3	A4	A5
RPEE	MJ	3,58E+00	7,63E-03	0,00E+00
RPEM	MJ	5,26E-07	0,00E+00	0,00E+00
TPE	MJ	3,58E+00	7,63E-03	0,00E+00
NRPE	MJ	2,32E+01	5,17E+00	0,00E+00
NRPM	MJ	3,62E+00	4,69E+00	0,00E+00
TRPE	MJ	2,32E+01	5,17E+00	0,00E+00
SM	kg	1,97E-03	1,68E-05	0,00E+00
RSF	MJ	0,00E+00	0,00E+00	0,00E+00
NRSF	MJ	0,00E+00	0,00E+00	0,00E+00
W	m^3	3,42E-01	5,23E-04	0,00E+00

RPEE *Renewable primary energy resources used as energy carrier;* ***RPEM*** *Renewable primary energy resources used as raw materials;* ***TPE*** *Total use of renewable primary energy resources;* ***NRPE*** *Nonrenewable primary energy resources used as energy carrier;* ***NRPM*** *Nonrenewable primary energy resources used as materials;* ***TRPE*** *Total use of non-renewable primary energy resources;* ***SM*** *Use of secondary materials;* ***RSF*** *Use of renewable secondary fuels;* ***NRSF*** *Use of non-renewable secondary fuels;* ***W*** *Use of net fresh water.*

End of life – Waste

Parameter	Unit	A1-A3	A4	A5
HW	kg	8,08E-02	6,14E-03	0,00E+00
NHW	kg	1,04E-06	1,33E-11	0,00E+00
RW	m^3	1,48E-08	1,70E-10	0,00E+00

HW *Hazardous waste disposed;* ***NHW*** *Non-hazardous waste disposed;* ***RW*** *Radioactive waste disposed.*

End of life – output flow

Parameter	Unit	A1-A3	A4	A5
CR	kg	0,00E+00	0,00E+00	0,00E+00
MR	kg	1,16E-01	0,00E+00	0,00E+00
MER	kg	0,00E+00	0,00E+00	0,00E+00
EEE	MJ	0,00E+00	0,00E+00	0,00E+00
ETE	MJ	0,00E+00	0,00E+00	0,00E+00

***CR** Components for reuse; **MR** Materials for recycling; **MER** Materials for energy recovery; **EEE** Exported electric energy; **ETE** Exported thermal energy.*

Information describing the biogenic carbon content at the factory gate

Biogenic carbon content	Unit	Value
Biogenic carbon content in product	kg C	0
Biogenic carbon content in the accompanying packaging	kg C	0,03

Additional requirements

Location based electricity mix from the use of electricity in manufacturing

National production mix from import, medium voltage (production of transmission lines, in addition to direct emissions and losses in grid) of applied electricity for the manufacturing prosess (foreground/core) per functional unit.

National electricity grid	Unit	Value GWP_{total}
Electricity, medium voltage {PL} | market for electricity, medium voltage, ecoinvent 3.9	kg CO2 -eq/kWh	0,885

Guarantees of origin from the use of electricity in the manufacturing phase

Where guarantees of origin is applied in stead of national production mix – the electricity for the manufacturing prosess (A3) shall be stated clearly in the EPD per functional unit.

Electricity source	Foreground / core [kWh]	GWP_{total} [kg CO2 -eq/kWh]	SUM [kgCO2 -eq]
Guarantee of origin electricity used in the foreground	0	0	0
Residual mix electricity used in the foreground	0,056	1,09	0,06

The residual mix is calculated using the following methodology based on AIB methodology.

Residual electricity mix	Unit	Value GWP_{total}
Electricity, medium voltage {PL}| electricity, medium voltage, residual mix, ecoinvent 3.9	kg CO2 -eq/kWh	1,09

Additional environmental impact indicators required for construction products

In order to increase the transparency of biogenic carbon contribution to climate impact, the indicator GWP-IOBC is required as it declares climate impacts calculated according to the principle of instantaneous oxidation. GWP-IOBC is also referred to as GWP-GHG in context to Swedish public procurement legislation.

Parameter	Unit	A1-A3	A4	A5
GWP-IOBC	kg	1,46E+00	3,89E-01	2,09E-01

GWP-IOBC *Global warming potential calculated according to the principle of instantaneous oxidation.*

Hazardous substances

The declaration is based upon reference to threshold values and/or test results and/or material safety data sheets provided to EPD verifiers. Documentation available upon request to EPD owner.

- ■ The product contains no substances given by the REACH Candidate list.
- □ The product contains substances given by the REACH Candidate list that are less than 0,1 % by weight.
- □ The product contains dangerous substances, more then 0,1% by weight, given by the REACH Candidate List, see table.
- ■ The product is classified as hazardous waste, see table.

Name	CAS no.	Amount
Ammonium nitrate	6484-52-2	62-66
Glyceryl trinitrate	55-63-0	29-33
Ethylene glycol dinitrate	628-96-6	29-33
Nitrocellulose	9004-70-0	0.3-2

Indoor environment

The product meets the requirements for low emissions.

Not relevant. No tests have been carried out on the product concerning indoor climate.

Carbon footprint

While a carbon footprint analysis has not been conducted for the product separately, the results section does include an evaluation of Global Warming Potential (GWP) with such an analysis. The GWP total results presented in this EPD document represents the carbon footprint of the product studied

Bibliography

ISO 14025:2010	Environmental labels and declarations - Type III environmental declarations - Principles and procedures
ISO 14044:2006	Environmental management - Life cycle assessment - Requirements and guidelines
EN 15804:2012+A2:2019	Sustainability of construction works - Environmental product declaration - Core rules for the product category of construction products
ISO 21930:2007	Sustainability in building construction - Environmental declaration of building products
Simapro	LCA software by Pre Sustainability
NPCR PART A	Construction Products and Services. Ver 2.0.
NPCR 024 2021 ver. 2.0	Explosives and Initiation Systems, Version 2.0. Norwegian EPD Foundation, 2021.
LCA report	Life cycle assessment (LCA) ERGODYN 31E NITROERG S.A. KGHM Group.

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