

Environmental Product Declaration

In accordance with 14025 and EN15804 +A2

Emulex 1



The Norwegian
EPD Foundation

Owner of the declaration:
Austin Powder GmbH

Product name:
Emulex 1

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

Product category /PCR:
Packaged explosives/ NPCR 024:2021 version
2.0 Explosives and Initiation Systems, NPCR
Part A: Construction products and services,
version 2.0

Program holder and publisher:
The Norwegian EPD foundation

Declaration number:
NEPD-5023-3977-EN

Registration number:
NEPD-5023-3977-EN

Issue date: 28.09.2023

Valid to: 28.09.2028

General information



Product:

Emulex 1

Program Operator:

The Norwegian EPD Foundation
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Declaration Number:

NEPD-5023-3977-EN

This declaration is based on Product Category Rules:

NPCR 024:2021 version 2.0 Explosives and Initiation Systems

NPCR Part A: Construction products and services. Version 2.0.

Statements:

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 product)

Verification:

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

internal

external



Mie Vold, LCA.no AS
Independent verifier approved by EPD Norway

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Management system:

ISO 9001

Organisation no:

ATU56875929

Issue date:

28.09.2023

Valid to:

28.09.2028

Year of study:

Primary data represents year 2021. Study conducted in 2023.

Comparability:

EPDs from other programmes than EPD Norge/ The Norwegian EPD foundation may not be comparable.

The EPD has been worked out by:

Emma Salminen and Lassi Leinonen, Etteplan Finland Oy

Approved



Manager of EPD Norway



Product

Product description:

Emulex 1 is a detonator sensitive emulsion with an excellent combination of velocity of detonation and good gas generation characteristics. Widely used in surface mining blasting, quarrying and construction work. Suitable for use as a column load or base charge. Emulex 1 is also suitable for tunneling applications and for use as booster charge for less sensitive explosives such as ANFO and blasting agents.

Product specification:

General product type: Emulsion explosives, cartridge

Raw materials per declared unit (1 kg product)	%
Ammonium nitrate	60-80%
Distillates (petroleum)	4-8%
Sodium nitrate	10-15%
Packaging materials per declared unit (1 kg product)	kg
Cartridge film	0.008
Metal foil	0.0003

In addition to primary package, Emulex 1 cartridges are packaged into cardboard boxes wrapped with plastic to protect them in transportation and storing before use. Both primary and secondary packing materials are considered in the modelling.

Technical data:

EC-type examination certificate: 0589.EXP.3571/09

Energy content (MJ/ea): 3.041

Market:

Europe

Reference service life, product:

Not relevant. Explosives cannot be used several times.

LCA: Calculation rules

Declared unit:

1 kg of manufactured, installed and used (detonated product) explosive product and its package

Data quality:

Data quality assessment is performed extensively for used modelling data. Data quality level and criteria of the UN Environment Global Guidance on LCA database development was applied in



data quality assessment. Best available data was used in the modelling. Primary data from year 2022 is applied. Of priority, primary data is used. Secondary data from Sphera professional 2023 and Ecoinvent 3.9.1 databases is used when primary data is not accessed. Used secondary data is no older than 10 years.

Allocation:

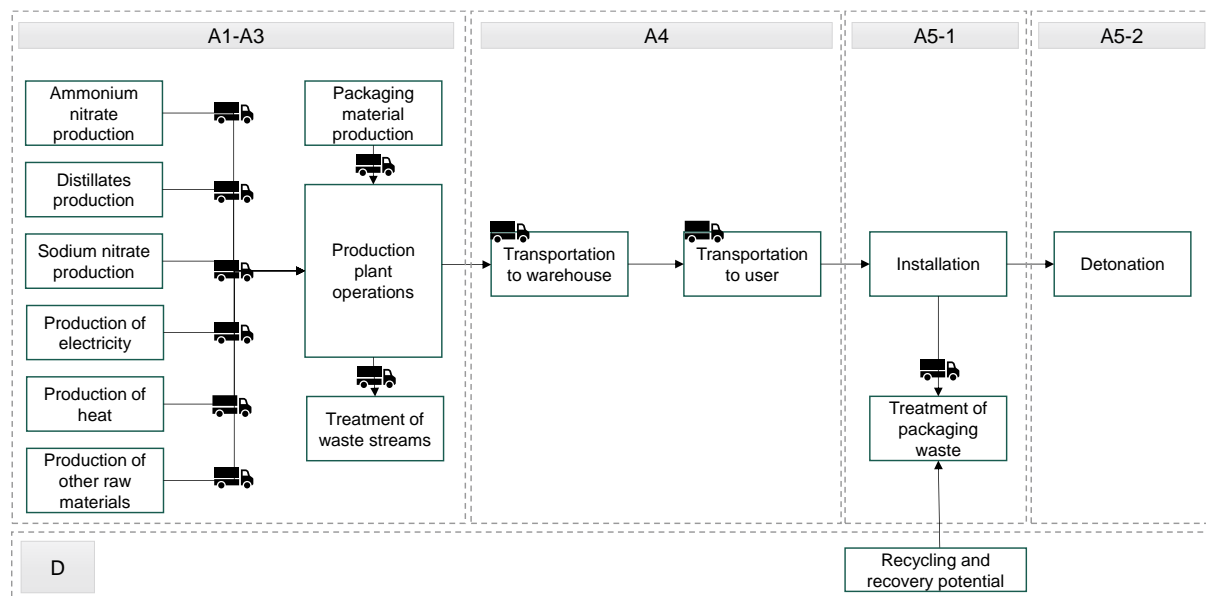
Allocation procedure described in ISO 14044:2006, section 4.3.4 is followed.

Annual consumption of district heat, onsite produced heat, water and electricity and waste streams generated in production plant are allocated evenly to all products manufactured based on production volumes.

In allocation of the recycling and recovery processes, taking place in the modules A1, A3, and A5-1, the “polluter pays” principle is applied. Thus, the environmental burden related to waste stream treatment are allocated to the system producing them until end-of waste state has been met. Corresponding definition is used also for recycled materials entering the system.

System boundary:

System boundary includes all life cycle stages relevant for explosive products. Product studied is detoned in A5-1 stage and thus module B or C are not applicable.



Cut-off criteria:

Cut-off criterion based on mass and energy is adhered to. The cut-off rule is reflected in the inputs and outputs of each separate module in the studied product system. Flows accounting less than 1% of the overall input mass or energy flows are excluded from the study if appropriate primary, secondary or even proxy data are not available.

- Capital equipment, infrastructure and employee commute are excluded.
- Production of pallets and possible plastic wrapping materials used in transportation and auxiliary fuels used in reject explosive waste treatment at production site are excluded.
- Production of detonators used in A5-1 stage are excluded.



LCA: Scenarios and additional technical information

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

Transport from production place to user (A4)

Transportation of product to its customer is modelled based on average Norwegian customer. Product is first transported to storage located in Norway using trucks and Ro-Ro ship over Baltic Sea. From storage in Norway, the studied explosives are transported to user site using van.

Type	Capacity utilisation (incl. return) %	Type of vehicle	Distance (km)	Fuel	value (l/tkm)
Truck	64%	EURO6 truck, 16t payload capacity	1755	Diesel with 6.91% bio-content	0.03
Ro-Ro ship	64%	Ro-Ro ship, 8000DWT	164	Light Fuel Oil	0.001
Van	50%	EURO6d, 1.5t payload capacity	100	Diesel with 6.91% bio-content	0.13

Installation (A5-1)

The cartridges are unpacked from corrugated board boxes and installed. Drilling of blast holes and usage of detonators and other auxiliary materials are excluded. Cardboard and plastic used to protect cartridges in transportation are assumed to be directed to nearest material recovery site.

Waste treatment	Unit	Value
Output materials to material recovery	kg	0.041

Detonation (A5-2)

Detonation emissions to air are calculated from the ideal theoretical composition of Emulex 1, based on balanced chemical reaction at final state and 1 bar, for the decomposition of the explosive, using stoichiometry and thermochemistry.

Substance	Unit	Value
Carbon, C	kg	0
Methane, CH ₄	kg	0
Carbon dioxide, CO ₂	kg	0.133
Carbon monoxide, CO	kg	0.027
Water (vapour), H ₂ O	kg	0.492
Nitrogen, N ₂	kg	0.259
Nitrogen oxides, NO _x	kg	0.038
Sodium carbonate, Na ₂ CO ₃	kg	0.086



Use stage (B1-B7)

Use stage is not relevant for explosives since product is fully detonated in A5 stage.

End of Life (C1-C4)

Product is fully detonated during use phase. Therefore C module is not relevant.

Benefits and loads beyond the system boundaries (D)

Packaging materials used to cover cartridges of Emulex 1 are assumed to be directed material recovery site in the A5-1 stage.

Waste treatment	Unit	Value
Packaging material directed to material recovery (A5-1)	kg	0.041

LCA: Results

Impact assessment results are presented with core and additional impact indicators presented in EN15804+A2. Reading example: 9,0 E-03 = $9,0 \cdot 10^{-3} = 0,009$

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

Product stage			Assembly stage		Use stage								End of life stage				Benefits & loads beyond system boundary
Raw materials	Transport	Manufacturing	Transport	Assembly	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	X	



Core environmental impact indicators

Indicator	Unit	A1-3	A4	A5-1	A5-2	D
GWP-total	kg CO ₂ eq.	1.48E+00	2.23E-01	4.08E-02	1.75E-01	-1.59E-02
GWP-fossil	kg CO ₂ eq.	1.50E+00	2.21E-01	2.31E-02	1.75E-01	-1.58E-02
GWP-biogenic	kg CO ₂ eq.	-1.76E-02	0.00E+00	1.76E-02	0.00E+00	0.00E+00
GWP-LULUC	kg CO ₂ eq.	6.66E-04	1.94E-03	7.94E-05	0.00E+00	-5.62E-05
ODP	kg CFC11 eq.	7.18E-09	3.33E-14	4.25E-14	0.00E+00	-1.63E-13
AP	mol H ⁺ eq.	4.13E-03	3.61E-04	4.63E-05	2.81E-02	-9.03E-05
EP-freshwater	kg P eq.	1.12E-04	7.68E-07	6.44E-07	0.00E+00	-7.02E-07
EP-marine	kg N eq.	2.83E-03	1.38E-04	2.16E-05	1.48E-02	-3.89E-05
EP-terrestrial	mol N eq.	1.45E-02	1.59E-03	2.05E-04	1.62E-01	-3.72E-04
POCP	kg NMVOC eq.	2.58E-03	3.77E-04	4.27E-05	3.92E-02	-1.05E-04
ADP-M&M	kg Sb eq.	4.97E-06	1.40E-08	9.86E-09	0.00E+00	-5.19E-09
ADP-fossil	MJ	2.24E+01	2.98E+00	3.21E-01	0.00E+00	-2.41E-01
WDP	m ³	3.16E-01	2.64E-03	6.12E-04	0.00E+00	-3.67E-03

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; **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

Classification of disclaimers to the declaration of core and additional environmental impact indicators

ILCD classification	Indicator	Disclaimer
ILCD type / level 1	Global warming potential (GWP)	None
	Depletion potential of the stratospheric ozone layer (ODP)	None
ILCD type / level 2	Acidification potential, Accumulated Exceedance (AP)	None
	Eutrophication potential, Fraction of nutrients reaching marine end compartment (EP-marine)	None
	Eutrophication potential, Accumulated Exceedance (EP-terrestrial)	None
ILCD type / level 3	Formation potential of tropospheric ozone (POCP)	None
	Abiotic depletion potential for non-fossil resources (ADP-minerals&metals)	2
	Abiotic depletion potential for fossil resources (ADP-fossil)	2



	Water (user) deprivation potential, deprivation-weighted water consumption (WDP)	2
Disclaimer 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	A1-3	A4	A5-1	A5-2	D
RPEE	MJ	2.82E+00	2.10E-01	1.31E+00	0.00E+00	-1.20E+00
RPEM	MJ	6.15E-01	0.00E+00	-6.15E-01	0.00E+00	0.00E+00
TPE	MJ	3.43E+00	2.10E-01	6.99E-01	0.00E+00	-1.20E+00
NRPE	MJ	1.98E+01	2.99E+00	3.36E-01	0.00E+00	-2.41E-01
NRPM	MJ	2.52E+00	0.00E+00	-1.42E-02	0.00E+00	0.00E+00
TRPE	MJ	2.24E+01	2.99E+00	3.21E-01	0.00E+00	-2.41E-01
SM	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	m ³	8.02E-03	2.33E-04	3.33E-04	0.00E+00	-1.63E-04

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 Non-renewable primary energy resources used as energy carrier; NRPM Non-renewable 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	A1-3	A4	A5-1	A5-2	D
HW	kg	4.35E-04	1.50E-11	1.12E-08	0.00E+00	-8.52E-09
NHW	kg	6.24E-03	4.56E-04	1.03E-03	0.00E+00	-1.31E-03
RW	kg	1.97E-04	5.76E-06	7.30E-06	0.00E+00	-1.15E-05

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

End of life – output flow

Parameter	Unit	A1-3	A4	A5-1	A5-2	D
CR	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MR	kg	8.44E-05	0.00E+00	4.13E-02	0.00E+00	0.00E+00
MER	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EEE	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ETE	MJ	0.00E+00	0.00E+00	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	0.018

Additional Norwegian requirements

Greenhouse gas emission from the use of electricity in the manufacturing phase

National production mix from import, low voltage (production of transmission lines, in addition to direct emissions and losses in grid) of applied electricity for the manufacturing process (A3).

National electricity grid	Unit	Value
Austria, national electricity grid mix	kg CO ₂ -eq./kWh	0.248

Additional environmental impact indicators required in NPCR Part A 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.

Indicator	Unit	A1-3	A4	A5-1	A5-2	D
GWP-IOBC	kg CO ₂ eq.	1.50E+00	2.24E-01	2.33E-02	1.75E-01	-1.60E-02

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.

x	The product contains no substances given by the REACH Candidate list or the Norwegian priority list.
	The product contains substances given by the REACH Candidate list or the Norwegian priority list that are less than 0,1 % by weight.
	The product contain dangerous substances, more then 0,1% by weight, given by the REACH Candidate List or the Norwegian Priority list, see table.
	The product contains no substances given by the REACH Candidate list or the Norwegian priority list.
	The product is classified as hazardous waste (Avfallsforskiten, Annex III).



Indoor environment

Product shall not be used indoor.

Carbon footprint

Carbon footprint has not been worked out for the product separately. 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
NPCR 024:2021 version 2.0	Explosives and Initiation Systems
NPCR Part A:	Construction products and services. Version 2.0.
Etteplan Finland. 2023.	LCA background report for EPD of Emulex 1 – cartridge explosive

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