epd-norway
Global Program Operator

ENVIRONMENTAL PRODUCT DECLARATION

in accordance with ISO 14025, ISO 21930 and EN 15804

Owner of the declaration:	Orica Norway AS
Program operator:	The Norwegian EPD Foundation
Publisher:	The Norwegian EPD Foundation
Declaration number:	NEPD-4018-3055-EN
Registration number:	NEPD-4018-3055-EN
ECO Platform reference number:	-
Issue date:	07.12.2022
Valid to:	07.12.2027

Packaged explosives.
EXAN E, EXAN EA

Orica Norway AS

www.epd-norge.no

General information

Product:
Packaged explosives: EXAN E, EXAN EA

Owner of the declaration:
Orica Norway AS
Contact person: Johan Røneid
Phone: +47 32 22 91 00
e-mail: johan.roeneid@orica.com

Program operator:
The Norwegian EPD Foundation
Postboks 5250 Majorstuen, 0303 Oslo
Phone: +47 23 08 80 00
e-mail: post@epd-norge.no

Manufacturer:
Orica Norway AS

Declaration number:
NEPD-4018-3055-EN

Place of production:
Gyttorp, Sweden

ECO Platform reference number:

Management system:
ISO 9001

This declaration is based on Product Category Rules:
CEN Standard EN 15804 serves as core PCR
NPCR 024 version 1.0 Explosives and Initiation Systems (03/2016)

Organisation no:
981 413 156

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 information, life cycle assessment data and evidences.

Issue date:
07.12.2022

Valid to:
07.12.2027

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

Year of study:
LCA conducted in 2022. Production inventory data has been collected for 2021.

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

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

Functional unit:
Declared unit is applied instead of functional unit.

The EPD has been worked out by:
Kristine Bjordal
Asplan Viak AS

Verification:
The CEN Norm EN 15804 serves as the core PCR. Independent verification of the declaration and data, according to ISO14025:2010

☐ internal ☑ external

Third party verifier:

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

Approved

Håkon Hauan
Managing Director of EPD-Norway

Product

Product description:
These packaged explosive ANFO-products are manufactured at Orica's factory at Gyttorp, Sweden, then transported to the customer via an intermediate storage site. The customer brings the product to the use site and charges the product manually or by use of their own charging equipment into bore holes. The charged bore holes are then detonated.

Technical data:
1 kg explosives product

EU-type examination certificate:
EXP 1395-010/2019

Market:
Nordic countries
(Norway, Sweden, Finland, Denmark, Iceland)

Reference service life, product:
Not relevant. Explosives cannot be used more than once.

Product specification:
Energy content of declared products:

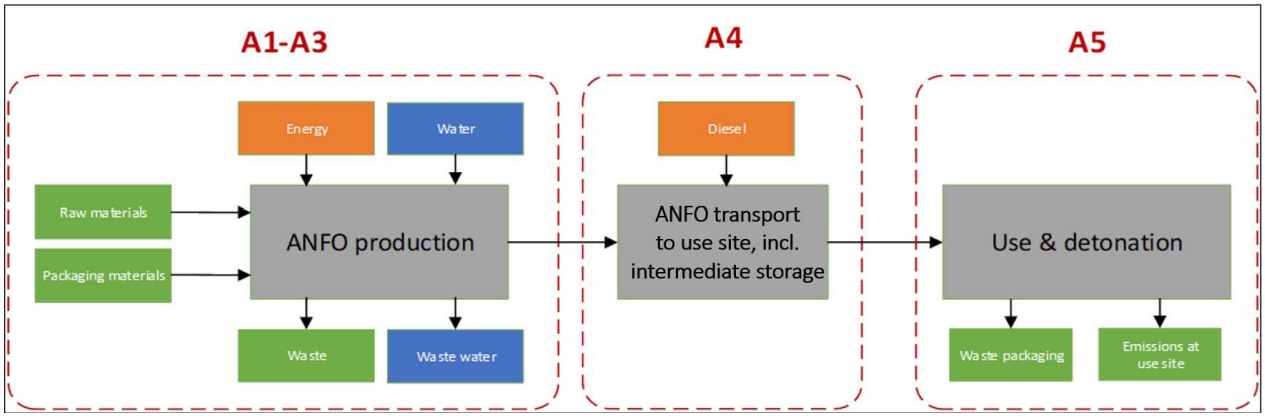
	EXAN E	EXAN EA
Heat of Reaction (MJ/kg)	3,83	4,40
Effective Energy (MJ/kg)	2,24	2,53

Materials	EXAN E	EXAN EA
Ammonium nitrate	80-95 %	80-95 %
Destillates (petroleum)	5 - < 10 %	2.5 - <5 %
Aluminimum powder		5 - <10 %
Packaging		
Plastic bag (kg/kg product)	0,004	0,004

LCA: Calculation rules

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

System boundary:
The flow chart for production, transport and use of packaged explosive is shown in the figure below.



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 Gyttorp and storage facilities in Norway. Detonation of explosives has been calculated from a balanced chemical reaction, at final state and 1 bar (IDeX code, ideal detonation). Specific producer data on ammonium nitrate production has been used for GWP, while the other impact categories are based on generic data and this may cause a mismatch between GWP and energy use. Generic data is from ecoinvent v3.8, Allocation, Cut-Off by classification (May 2022) SimaPro v 9.1.1.1. Characterization factors from EN15804: 2012 + A1: 2013.

Cut-off criteria:
All major raw materials and all the essential energy is included. The production process for raw materials and energy flows that are included with very small amounts (<1%) are not included. This cut-off rule does not apply for hazardous materials and substances.

Allocation:
The allocation is made in accordance with the provisions of EN 15804. Incoming energy and water and waste production in-house is allocated equally among all products through mass allocation. Effects of primary production of recycled materials allocated to the main product in which the material was used.

LCA: Scenarios and additional technical information

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

This declaration is based on a "cradle to gate with options" assessment, including A1-A3: Production at factory, A4: transport from factory to intermediate storage and use site; as well as A5: Manufacture, charging and detonation of explosives at site. The A5 phase is included, as it represents the part of the life cycle in which the explosive is fulfilling its intended function (detonation). The charging of explosives scenario (A5-1) requires no auxiliary materials or substances used in the installation, and only waste treatment of packaging products are included. Detonation of explosives has been calculated from a balanced chemical reaction, at final state and 1 bar (IDeX code, ideal detonation).

The declaration represents pacakaged explosives produced at Gyttorp, Sweden. For the transport of ANFO from the storage to use site (A4), a distance of 70 km has been used, representative of average distance to construction site in Norway. Two alternatives are provided, one where the product is transported by a van and one with a truck.

Transport from factory to intermediate storage site (A4)

					All products
Type	Capacity utilisation %	Type of vehicle	Fuel/Energy	Value	Distance km
Truck	100 %	Lorry	l/tkm	0,016	340

Transport from intermediate storage site to user (A4), alternative 1

					All products
Type	Capacity utilisation %	Type of vehicle	Fuel/Energy	Value	Distance km
Truck	95 %	Van	l/tkm	0,081	70

Transport from intermediate storage site to other storage locations (A4), alternative 2

					All products
Type	Capacity utilisation %	Type of vehicle	Fuel/Energy	Value	Distance km
Truck	95 %	Lorry	l/tkm	0,016	70

Manufacture and charging of explosives (A5-1)

	Unit	All products
Diesel consumption*	l	0
Packaged explosive consumption	kg	1
Gassing agent consumption	kg	0
Glycol consumption**	kg	0
Water consumption	kg	0

Detonation of explosives (A5-2)

Emissions to air	Unit	EXAN E	EXAN EA
Carbon	kg		
Methane	kg	0,01717	0,01801
Carbon dioxide	kg	0,20841	0,16252
Carbon monoxide	kg		0,00010
Water	kg	0,45900	0,41277
Nitrogen	kg	0,31544	0,30137
Almina	kg		0,10000

Theoretical calculations per kg explosive product detonated, from a balanced chemical reaction, at final state and 1 bar (IDeX code, Ideal detonation)

LCA: Results

The LCA results show environmental impacts, resource use and outflows calculated according to EN 15804: 2012 + A1: 2013. The results are per kg packaged explosive, manufactured, charged and detonated at use site. Results are given for all declared product types for A1-A3, A5-1 and A5-2. A4 is similar for both product types. Transport in A4 is 70 km to an average Norwegian construction site, alternative 1 represent by van and alternative 2 represent by truck.

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

Product stage			Assemby stage			Use stage							End of life stage				Beyond the system boundaries
Raw materials	Transport	Manufacturing	Transport	Manufacture and charging	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	A5-1	A5-2	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND

Environmental impact

		EXAN E	EXAN EA	Both		EXAN E	EXAN EA	EXAN E	EXAN EA
Parameter	**Unit**	**A1- A3**	**A1- A3**	**A4 (alt. 1)**	**A4 (alt. 2)**	**A5-1**	**A5-1**	**A5-2**	**A5-2**
GWP	kg CO_2 -eqv	1,25E+00	1,35E+00	7,64E-02	3,76E-02	9,77E-02	9,77E-03	6,38E-01	6,13E-01
ODP	kg CFC11-eqv	1,79E-07	1,80E-07	1,06E-08	5,63E-09	1,07E-08	1,07E-09	1,00E+00	5,00E+00
POCP	kg C_2H_4 -eqv	1,84E-04	2,15E-04	5,05E-05	8,30E-06	4,86E-06	4,86E-07	1,03E-04	1,11E-04
AP	kg SO_2 -eqv	6,65E-03	7,11E-03	6,11E-04	2,01E-04	1,27E-04	1,27E-05	1,00E+00	5,00E+00
EP	kg PO_4^{3-}-eqv	2,61E-03	2,67E-03	1,26E-04	5,18E-05	2,04E-05	2,04E-06	1,32E-01	1,27E-01
ADPM	kg Sb-eqv	2,51E-05	3,11E-05	2,38E-06	4,34E-07	1,98E-07	1,98E-08	0,00E+00	0,00E+00
ADPE	MJ	2,54E+01	2,62E+01	1,20E+00	5,74E-01	4,88E-01	4,88E-02	0,00E+00	0,00E+00

GWP Global warming potential; ODP Depletion potential of the stratospheric ozone layer; POCP Formation potential of tropospheric photochemical oxidants; AP Acidification potential of land and water; EP Eutrophication potential; ADPM Abiotic depletion potential for non fossil resources; ADPE Abiotic depletion potential for fossil resources

Resource use

		EXAN E	EXAN EA	Both		EXAN E	EXAN EA	EXAN E	EXAN EA
Parameter	**Unit**	**A1- A3**	**A1- A3**	**A4 (alt. 1)**	**A4 (alt. 2)**	**A5-1**	**A5-1**	**A5-2**	**A5-2**
RPEE	MJ	7,48E-01	7,49E-01	1,03E-01	5,81E-02	1,80E-02	1,80E-03	0,00E+00	0,00E+00
RPEM	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
TPE	MJ	7,48E-01	7,49E-01	1,03E-01	5,81E-02	1,80E-02	1,80E-03	0,00E+00	0,00E+00
NRPE	MJ	2,41E+01	2,47E+01	1,21E+00	5,66E-01	4,81E-01	4,81E-02	0,00E+00	0,00E+00
NRPM	MJ	2,56E+00	2,05E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
TRPE	MJ	2,66E+01	2,68E+01	1,21E+00	5,66E-01	4,81E-01	4,81E-02	0,00E+00	0,00E+00
SM	kg	0,00E+00	5,50E-02	0,00E+00	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	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	0,00E+00	0,00E+00	0,00E+00
W	m^3	-5,68E-03	-4,87E-03	-1,28E-03	-6,03E-04	-5,30E-05	-5,30E-06	0,00E+00	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 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

		EXAN E	EXAN EA	Both		EXAN E	EXAN EA	EXAN E	EXAN EA
Parameter	**Unit**	**A1- A3**	**A1- A3**	**A4 (alt. 1)**	**A4 (alt. 2)**	**A5-1**	**A5-1**	**A5-2**	**A5-2**
HW	kg	4,39E-05	1,20E-04	3,55E-05	2,31E-06	1,69E-06	1,69E-07	0,00E+00	0,00E+00
NHW	kg	1,59E-01	2,01E-01	1,16E-01	6,43E-02	1,90E-02	1,90E-03	0,00E+00	0,00E+00
RW	kg	5,33E-05	5,31E-05	6,89E-06	3,20E-06	2,82E-06	2,82E-07	0,00E+00	0,00E+00

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

End of life - Output flow (INA = Information not available)

		EXAN	EXAN A	Both		EXAN	EXAN A	EXAN	EXAN A
Parameter	**Unit**	**A1- A3**	**A1- A3**	**A4 (alt. 1)**	**A4 (alt. 2)**	**A5-1**	**A5-1**	**A5-2**	**A5-2**
CR	kg	INA	INA	INA	INA	INA	INA	INA	INA
MR	kg	INA	INA	INA	INA	INA	INA	INA	INA
MER	kg	INA	INA	INA	INA	INA	INA	INA	INA
EEE	MJ	0,00E+00	0,00E+00	0,00E+00	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	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

Reading example: 9,0 E-03 = $9,0*10^{-3}$ = 0,009

Additional Norwegian requirements

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

National production mix from Sweden with import, on medium voltage (included production of transmission lines, in addition to direct emissions and losses in grid) is applied for electricity in the manufacturing prosess (A3). National production mix from Norway is applid for the intermediate storage in A4. The annual production volumes of this market are taken from IEA/OECD statistics and are valid for the year 2018 (ecoinvent 3.8).

Data source	Amount	Unit
Electricity, norwegian production mix, with import, medium voltage, Econinvent v3.8	0,022	kg CO_2-eqv/kWh
Electricity, Sweden production mix, with import, medium voltage, Econinvent v3.8	0,044	kg CO2-eqv/kWh

Dangerous substances

- ☐ 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 contains 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 (Avfallsforskiften, §11-2), see table.

		Amount	
Name	CAS no.	EXAN E	EXAN EA
Ammonium nitrate	6484-52-2	90-95%	80-95%
Distillates (petroleum), solvent-dewaxed heavy paraffinic		5-<10%	2.5 - <5%
Alumnium powder		0	5 - <10%

Indoor environment

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

Carbon footprint

Carbon footprint has not been worked out for the product.

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+A1:2013	*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*
Ecoinvent v3.8, 2021	*Swiss Centre of Life Cycle Inventories.* https://www.ecoinvent.org/
SimaPro	*LCA software, developed by PRé Sustainability* https://simapro.com/
NPCR 024 2016 ver. 1.0	*Explosives and Initiation Systems*
Bjordal, Kristine, 2022	*LCA Report Packed Emulsion Explosives ANFO, Orica Norway AS 17.10.2022*

epd-norway Global Program Operator	**Program operator** The Norwegian EPD Foundation Post Box 5250 Majorstuen, 0303 Oslo Norway	Phone: e-mail: web	+47 23 08 80 00 post@epd-norge.no www.epd-norge.no
epd-norway Global Program Operator	**Publisher** The Norwegian EPD Foundation Post Box 5250 Majorstuen, 0303 Oslo Norway	Phone: e-mail: web	+47 23 08 80 00 post@epd-norge.no www.epd-norge.no
ORICA	**Owner of the declaration** Orica Norway AS Røykenveien 18, 3427 Gullaug Norway	Phone: Fax e-mail: web	+47 32 22 91 00 +47 32 22 91 01 nordics@orica.com www.oricaminigservices.com
asplan viak	**Author of the Life Cycle Assessment** Asplan Viak AS Kristine Bjordal Abels gate 9, 7030 Trondheim, Norway	Phone: Fax e-mail: web	+47 41 79 94 17 asplanviak@asplanviak.no www.asplanviak.no