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-4080-3110-EN
Registration number:	NEPD-4080-3110-EN
ECO Platform reference number:	-
Issue date:	30.12.2022
Valid to:	30.12.2027

Bulk emulsion explosives.
Civec Control/Centra Gold 100/Fortis Extra 100/Subtek Velcro (Manufactured at Kavaheden)

Orica Norway AS

www.epd-norge.no

General information

Product:
Bulk emulsion explosives: Civec Control, Centra Gold 100, Fortis Extra 100 and Subtek Velcro

Owner of the declaration:
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Manufacturer:
Orica Norway AS

Declaration number:
NEPD-4080-3110-EN

Place of production:
Kavaheden, Sweden

ECO Platform reference number:

Management system:
ISO 9001

This declaration is based on Product Category Rules:
CEN Standard EN 15804+A1:2013 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:
30.12.2022

Valid to:
30.12.2027

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

Year of study:
LCA conducted i 2018/19 and updated in 2021 with new data for ammonium nitrate production. Updated with new product in 2022. Production inventory data has been collected in 2021 and 2022.

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:

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:
Julie Lyslo Skullestad
Julie Lyslo Skullestad, Aase Teknikk AS
(Independent verifier approved by EPD Norway)

Approved
Håkon Hauan
Managing Director of EPD-Norway

Product

Product description:
Semifinished products for the bulk emulsion explosives are produced at Orica's factory at Kavaheden, Sweden, then transported to storage site in Norway. The bulk emulsion explosives are further transported to the use site where the finished bulk emulsion explosives are manufactured and charged into the bore holes by use of Mobile Explosives Manufacturing Units (MEMUs). The finished bulk emulsion explosive is finally detonated.

Product specification:
In this EPD, the 4 declared products are categorised as follows:

ANE 7000: Civec Control (CC) /Centra Gold 100 (CG) / Fortis Extra 100 (FE)
ANE 7100: Subtek Velcro (SV)

Energy content of declared products:

	FE/CG	CC	SV
Density [kg/litre]	1,2	1,00	1,10
Heat of reaction [MJ/kg]	3,00	2,92	2,41
Effective Energy [MJ/kg]	2,45	2,13	2,13

Materials	CG/FE/CC	SV
Ammonium nitrate	60-80 %	60-80 %
Distillates (petroleum), solvent-dewaxed heavy paraffinic	2.5-<5 %	
Distillates (petroleum), hydrotreated light	1-<2.5%	
Distillates (petroleum), hydrotreated middle		1-<2.5%
Sodium nitrite	0.1-<0.25 %	0.1-<0.25 %

Technical data:
1 kg explosives product

EC-type examination certificates:
Civec Control: EXP 1395-009/2019
Centra Gold 100: EXP 1395-007/2019
Fortis Extra 100: EXP 1395-007/2019
Subtek Velcro: EXP 1395-011/2019

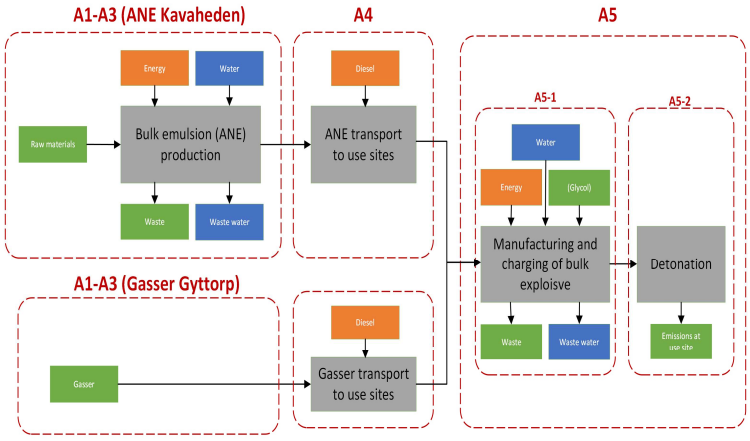
Market:
Norway

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

LCA: Calculation rules

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

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



Data quality:
Data has been collected in 2021 and is represetative of that year. Data for production (A1-A3), transport and storage of explosives (A4) is based on specific consumption data for the factory at Kavaheden and storage facility at Ballangen. 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. Generic data is from ecoinvent v3.4, v3.6, v3.7 and v3.8, Cut-off by classification and SimaPro v9. Characterisation method CML-IA baseline v 3.02 (based on CML v4.2).

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 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 at Kavaheden, Sweden,
A4: Transport to a standard use site via an intermediate storage at Ballangen, Norway. Distance to Ballangen is 500 km. Typical transport distances from the intermediate storage site to typical use sites are given in the tables below for the different products.
A5: Manufacture, charging and detonation of explosives at site.

A1-A3 inludes provision of all materials, products and energy. The main components that make up the bulk explosives are ANE and gasser. The ANE products are produced at Kavaheden, while the gasser is produced at Gyttorp.
A4 includes all transport after production at Kavaheden including transport of Gasser from production site to storage site.
A5 phase is included as it represents the part of the life cycle in which the explosive is fulfilling its indeded function (detonation).

Fortis Extra 100 / Centra Gold 100 (ANE 7000) are used for surface blasting using SSE trucks. Diesel is used as energy source during the charging operation on the surface.
Civec Control (ANE 7000) and Subtec Velcro (ANE 7100) are used only for underground blasting. Only electrical power supply is used during charging operations underground.
The energy use is the same for both surface blasting and underground blasting, only the energy source is different. Whether the product is charged above or below ground has a negligible effect on the LCA results (less than 0,1% for the installation phase), and data are thus averaged for above and below ground charging of explosives based on ANE 7000.

Detonation of explosives has been calculated from a balanced chemical reaction, at final state and 1 bar (IDeX code, ideal detonation).

Transport from factory to intermediate storage site (A4)

Type of product	Capacity utilisation %	Type of vehicle	Fuel/Energy	Unit	Distance km
ANE 7000 and ANE 7100	55 %	Tanker w/trailer	0,4	l/km	500
Gasser	95 %	Lorry	0,4	l/km	1500

Transport from intrmediate storage site to use site (A4)

Type of product	Capacity utilisation %	Type of vehicle	Fuel/Energy	Unit	Distance km
FE/CG	55 %	MEMU (SEE truck)	0,5	l/km	80
CC	55 %	Small UG MEMU	0,35	l/km	1
SV	55 %	Small UG MEMU	0,4	l/km	1

Manufacture and charging of explosives (A5-1)

	Unit	FE/CG	CC	SV
Diesel consumption*	l	0,002	0	0
Electricity consumption**	kWh	0	0,0202	0,0202
Bulk explosive consumption	kg	0,967	0,965	0,965
Gassing agent consumption	kg	0,01	0,011	0,011
Glycol consumption***	kg	0,0003	0,0001	0
Water consumption	kg	0,023	0,024	0,024

Detonation of explosives (A5-2)

Emissions to air	Unit	FE/CG/CC	SV
Carbon	kg	0,022	0,019
Methane	kg	0,00126	0,0015
Carbon dioxide	kg	0,122	0,118
Water	kg	0,583	0,594
Nitrogen	kg	0,268	0,262
Sodium carbonate	kg	0,0032	0,00037

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

*Diesel is only used for detonation above ground
**Electricity is only used for detonation underground
***Glycol is used in winter for frost protection

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 bulk explosive, manufactured, charged and detonated at use site. Results are given for all declared products for A1-A3, A4, A5-1 and A5-2.

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

		CC/CG/FE	SV	CG/FE	CC	SV	CC	CG/FE	SV	CC/CG/FE	SV
Parameter	**Unit**	**A1-A3**	**A1-A3**	**A4**	**A4**	**A4**	**A5-1**	**A5-1**	**A5-1**	**A5-2**	**A5-2**
GWP	kg CO_2-eqv	1,18E+00	1,16E+00	8,51E-02	6,63E-02	6,49E-02	6,85E-04	1,59E-03	5,12E-04	1,54E-01	1,56E-01
ODP	kg CFC11-eqv	1,95E-07	1,63E-07	1,31E-08	9,79E-09	9,51E-09	2,48E-11	1,15E-09	1,76E-11	0,00E+00	0,00E+00
POCP	kg C_2H_4-eqv	2,56E-04	2,52E-04	1,30E-05	1,13E-05	1,05E-05	1,91E-07	5,45E-07	1,44E-07	7,56E-06	9,00E-06
AP	kg SO_2-eqv	1,03E-02	1,02E-02	3,47E-04	2,95E-04	2,89E-04	3,85E-06	1,31E-05	3,22E-06	0,00E+00	0,00E+00
EP	kg PO_4^{3-}-eqv	7,07E-03	6,94E-03	1,03E-04	9,54E-05	9,45E-05	3,78E-07	2,93E-06	3,06E-07	1,13E-01	1,10E-01
ADPM	kg Sb-eqv	2,08E-05	2,06E-05	7,48E-07	6,91E-07	6,72E-07	6,26E-08	9,46E-09	6,02E-08	0,00E+00	0,00E+00
ADPE	MJ	2,23E+01	2,18E+01	1,16E+00	8,93E-01	8,68E-01	1,37E-02	1,02E-01	8,58E-03	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

		CC/CG/FE	SV	CG/FE	CC	SV	CC	CG/FE	SV	CC/CG/FE	SV
Parameter	**Unit**	**A1-A3**	**A1-A3**	**A4**	**A4**	**A4**	**A5-1**	**A5-1**	**A5-1**	**A5-2**	**A5-2**
RPEE	MJ	1,42E+00	1,22E+00	5,55E-01	5,53E-01	5,52E-01	8,24E-02	3,08E-03	8,22E-02	0,00E+00	0,00E+00
RPEM	MJ	5,26E-02	2,50E-02	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	1,47E+00	1,25E+00	5,55E-01	5,53E-01	5,52E-01	8,24E-02	3,08E-03	8,22E-02	0,00E+00	0,00E+00
NRPE	MJ	1,96E+01	1,92E+01	1,16E+00	8,93E-01	8,68E-01	1,36E-02	1,02E-01	8,58E-03	0,00E+00	0,00E+00
NRPM	MJ	2,70E+00	2,60E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
TRPE	MJ	2,23E+01	2,18E+01	1,16E+00	8,93E-01	8,68E-01	1,36E-02	1,02E-01	8,58E-03	0,00E+00	0,00E+00
SM	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	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	0,00E+00	0,00E+00
NRSF	MJ	2,23E+01	2,18E+01	1,16E+00	8,93E-01	8,68E-01	1,37E-02	1,02E-01	8,58E-03	0,00E+00	0,00E+00
W	m^3	-4,23E-03	-4,44E-03	-1,69E-04	-1,42E-04	-1,34E-04	2,30E-07	5,68E-06	2,16E-07	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

		CC/CG/FE	SV	CG/FE	CC	SV	CC	CG/FE	SV	CC/CG/FE	SV
Parameter	**Unit**	**A1-A3**	**A1-A3**	**A4**	**A4**	**A4**	**A5-1**	**A5-1**	**A5-1**	**A5-2**	**A5-2**
HW	kg	4,59E-05	3,93E-05	2,95E-06	2,53E-06	2,16E-06	1,01E-08	2,42E-07	8,17E-09	0,00E+00	0,00E+00
NHW	kg	2,90E-01	2,88E-01	7,98E-02	6,95E-02	6,89E-02	5,60E-04	2,45E-04	5,23E-04	0,00E+00	0,00E+00
RW	kg	6,95E-05	5,12E-05	7,66E-06	5,87E-06	5,71E-06	9,61E-08	6,38E-07	8,62E-08	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)

		CC/CG/FE	SV	CG/FE	CC	SV	CC	CG/FE	SV	CC/CG/FE	SV
Parameter	**Unit**	**A1-A3**	**A1-A3**	**A4**	**A4**	**A4**	**A5-1**	**A5-1**	**A5-1**	**A5-2**	**A5-2**
CR	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
MR	kg	INA	INA	INA	INA	INA	INA	INA	INA	INA	INA
MER	kg	INA	INA	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	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	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

Swedish national production mix with import, on low voltage (included production of transmission lines, in addition to direct emissions and losses in grid) is applied for electricity in the manufacturing prosess at Kavaheden. For electricity use at storage in Ballangen, Norwegian national production mixes with import (low voltage) are applied. The annual production volumes of these markets are taken from IEA/OECD statistics and are valid for the year 2018 (ecoinvent 3.8).

Electricity production mix	Data source	Amount	Unit
Manufacturing at Kavaheden: Swedish, with import, low voltage	Econinvent v3.8	0,0485	kg CO_2-eqv/kWh
Storage in Ballangen: Norwegian, with import, low voltage	Econinvent v3.8	0,0253	kg CO_2-eqv/kWh

Dangerous substances

☑ 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.	CG/FE/CC	SV
Ammonium Nitrate	6484-52-2	60 - 80%	60 - 80%
Distillates (petroleum), solvent-dewaxed heavy paraffinic	64742-65-0	2.5 - <5%	
Distillates (petroleum), hydrotreated light	64742-47-8	1 - <2.5%	
Distillates (petroleum), hydrotreated middle	64742-46-7		1 - <2.5%
Sodium Nitrite	7632-00-0	0.1 - <0.25%	0.1 - <0.25%

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 v3.6, March 2018 Ecoinvent v3.7, June 2021 Ecoinvent v3.8, June 2022	*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 Bulk Emulsion Explosives Orica Norway AS 18.12.22*
Yara International ASA 2020	*Carbon Footprint of Yara UltrAN® products manufactured in Köping, Sweden, 14.09.2020*

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