epd-norway
Global Program Operator

Environmental Product Declaration

In accordance with 14025 and EN15804 +A2

Senatel Powerfrag

ORICA

Owner of the declaration:
Orica

Product name:
Senatel Powerfrag

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

Product category /PCR:
CEN Standard EN 15804:2012+A2:2019 serves as core PCR. NPCR 024 version 2.0 Explosives and Initiation Systems (11/2021)

Program holder and publisher:
The Norwegian EPD foundation

Declaration number:
NEPD-4529-3786-EN

Registration Number:
NEPD-4529-3786-EN

Issue date: 07.06.2023

Valid to: 07.06.2028

The Norwegian
EPD Foundation

General

General information

Product:
Senatel Powerfrag

Program Operator:
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Declaration number:
NEPD-4529-3786-EN

This declaration is based on Product Category Rules:
CEN Standard EN 15804:2012+A2:2019 serves as core PCR. NPCR 024 version 2.0 Explosives and Initiation Systems (11/2021)

Statements:
This is a spesific EPD. 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) cartridged emulsion explosives product

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

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

internal ☐ external ■

Sign

Gaspard Philis & Ole M. K. Iversen (Mentor)
Independent verifier approved by EPD Norway

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Place of production:
Estonia

Management system:
ISO 9001

Organisation no:
981413156

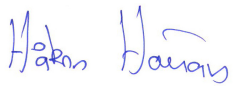
Issue date:
07.06.2023

Valid to:
07.06.2028

Year of study:
LCA conducted 2023. Production data from 2022.

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

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



Approved (Manager of EPD Norway)

Product

Product description:

The Senatel Powerfrag is cartridge emulsion explosives manufactured at the ORICA factory at Sirgala in Estonia, then transported to the customer via an intermediate storage site in Gyttorp (Sweden) or Bjønndalen (Norway). The customer brings the product to the use site and charges the product manually into bore holes. The charged bore holes are then detonated.

Product specification:

Materials	Senatel Powerfrag
Ammonium Nitrate	60-80 %
Sodium Nitrate	5-<10 %
Destillates (petroleum)	1-<2,5 %
Thiourea	0.1-<0.25 %
Packaging	
Cardboard/paper packaging (kg/kg product)	0,001

Energy	
Heat of Reaction (MJ/kg)	4,25
Effective Energy (MJ/kg)	2,7

Technical data:

EC-type examination certificate Nr. 0589.EXP.1672/08

Market:

Nordic countries

Reference service life, product:

Not relevant. Explosives products cannot be used more than once.

LCA: Calculation rules

Declared unit:

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

Data quality:

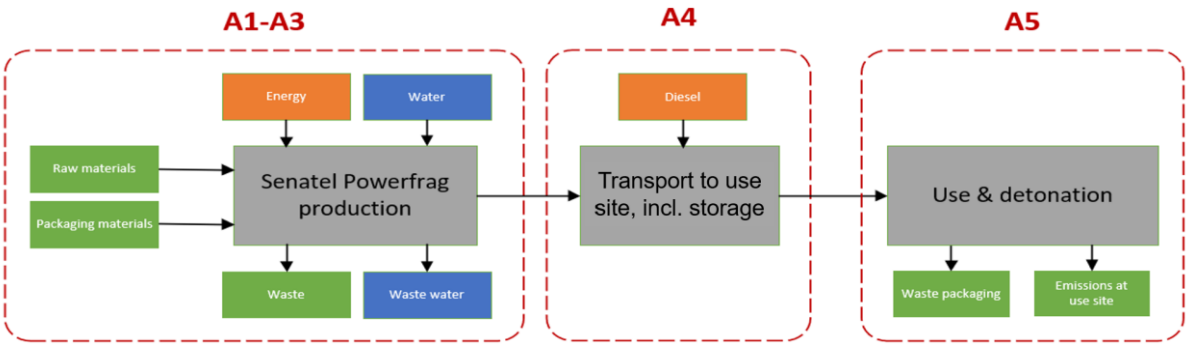
Data has been collected in 2023 and is representative of 2022. Data for production, transport and storage of explosives (A1-A3) is based on specific consumption data for the factory at Estonia and storage facilitiy in Norway and Sweden. Detonation of explosives has been calculated from a balanced chemical reaction, at final state and 1 bar (IDeX code, ideal detonation). 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 + A2: 2019.

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.

System boundary:

The system boundary is from cradle to gate (A1-A3) including mandatory modules A4 and A5. Other moduels are not relevant as the product is detonated in the use phase (A5). The flow chart for production, transport and use of cartridge emulsion explosive is shown in the figure below.



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.

LCA: Scenarios and additional technical information

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

Transport from production place to intermediat storage at Gyttorp, Sweden (A4 alt. 1)

Type	Capacity utilisation (incl. return) %	Type of vehicle	Distance KM	Fuel/Energy consumption	value (l/t)
Truck	100 %	Lorry, 16-32 tonnes, EURO6	2100	0,4 l/km	840
Ferry	NA	NA	95	NA	NA

Transport from production place to intermediate storage at Bjønndalen, Norway, (A4 alt. 2)

Type	Capacity utilisation (incl. return) %	Type of vehicle	Distance KM	Fuel/Energy consumption	value (l/t)
Truck	100 %	Lorry, 16-32 tonnes, EURO6	2440	0,4 l/km	976
Ferry	NA	NA	95	NA	NA

Transport from intermediate storage to use site (A4)

Type	Capacity utilisation (incl. return) %	Type of vehicle	Distance KM	Fuel/Energy consumption	value (l/t)
Truck	95 %	Van	60	0,1 l/km	6,3

Transportation distances and vehicles from the production plant to customer are defined based on typical transportation distance in the studied market. These figures represent the most likely scenario for the distribution of the product. Products are normally transported to intermediate storage in Gyttorp or Norway and then to the user. The average transportation distance presented here is based on the average over the market area. A4 also includes the intermediate storage of the product.

Manufacture and charging of explosives (A5-1)

	Unit	Value
Diesel consumption	Kg	0
Explosive consumption	Kg	1
Glycol consumption	Kg	0
Water consumption	kg	0
Treatment of waste from packaging material	kg	0,001

No energy or material is needed for the charging of the product, but waste generated from the packaging material is sent to waste treatment

Detonation of explosives (A5-2)

	Unit	Value
C	kg	0,054387
CH4	kg	0,00623
CO2	kg	0,1575
H2O	kg	0,487185
N2	kg	0,2771
Na2CO3	kg	0,054987

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

Additional technical information

Not relevant.

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

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	MNR

Core environmental impact indicators

Indicator	Unit	A1-A3	A4 alt 1	A4 alt 2	A5-1	A5-2
GWP-total	kg CO2 eq.	2,21E+00	1,75E-01	1,96E-01	2,46E-03	3,86E-01
GWP-fossil	kg CO2 eq.	2,21E+00	1,78E-01	2,00E-01	2,46E-03	3,86E-01
GWP-biogenic	kg CO2 eq.	-8,68E-03	-3,28E-03	-3,75E-03	4,60E-06	0,00E+00
GWP-LULUC	kg CO2 eq.	1,32E-02	2,27E-04	2,48E-04	5,76E-07	0,00E+00
ODP	kg CFC11 eq.	2,30E-07	3,48E-08	3,96E-08	2,94E-10	0,00E+00
AP	mol H^+ eq.	1,37E-02	1,53E-03	1,68E-03	3,89E-06	0,00E+00
EP-freshwater	kg P eq.	4,04E-05	5,50E-06	6,13E-06	5,22E-08	0,00E+00
EP-marine	kg N eq.	3,15E-03	6,13E-04	6,83E-04	7,85E-07	0,00E+00
EP-terrestial	mol N eq.	4,01E-02	5,72E-03	6,27E-03	8,74E-06	0,00E+00
POCP	kg NMVOC eq.	5,73E-03	1,51E-03	1,65E-03	2,39E-06	0,00E+00
ADP-M&M	kg Sb eq.	3,70E-05	3,09E-06	3,29E-06	4,95E-09	0,00E+00
ADP-fossil	MJ	3,86E+01	2,81E+00	3,17E+00	1,19E-02	0,00E+00
WDP	m^3	6,10E-01	3,01E-02	3,35E-02	3,24E-04	0,00E+00

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-terrestial:*** *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 counsumption*

Additional environmental impact indicators

Indicator	Unit	A1-A3	A4 alt 1	A4 alt 2	A5-1	A5-2
PM	Disease incidence	8,64E-08	3,20E-08	3,55E-08	3,53E-11	0,00E+00
IRP	kBq U235 eq.	6,25E-02	1,23E-02	1,38E-02	5,10E-05	0,00E+00
ETP-fw	CTUe	3,07E+01	4,09E+00	4,55E+00	4,74E-02	2,29E-01
HTP-c	CTUh	1,52E-09	3,23E-10	3,44E-10	1,53E-12	0,00E+00
HTP-nc	CTUh	2,77E-08	6,46E-09	7,17E-09	1,80E-11	0,00E+00
SQP	Dimensionless	8,75E+00	5,07E+00	5,74E+00	2,83E-03	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*

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
	Potential incidence of disease due to PM emissions (PM)	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
	Formation potential of tropospheric ozone (POCP)	None
	Potential Human exposure efficiency relative to U235 (IRP)	1
ILCD type / level 3	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

	Potential Comparative Toxic Unit for ecosystems (ETP-fw)	2
	Potential Comparative Toxic Unit for humans (HTP-c)	2
	Potential Comparative Toxic Unit for humans (HTP-nc)	2
	Potential Soil quality index (SQP)	2

Disclaimer 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.

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-A3	A4 alt 1	A4 alt 2	A5-1	A5-2
RPEE	MJ	1,89E+00	3,67E-01	4,17E-01	1,55E-02	0,00E+00
RPEM	MJ	1,50E-02	0,00E+00	0,00E+00	-1,50E-02	0,00E+00
TPE	MJ	1,90E+00	3,67E-01	4,17E-01	4,91E-04	0,00E+00
NRPE	MJ	2,97E+01	2,81E+00	3,17E+00	1,19E-02	0,00E+00
NRPM	MJ	8,99E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
TRPE	MJ	3,86E+01	2,81E+00	3,17E+00	1,19E-02	0,00E+00
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	2,34E-02	1,28E-03	1,45E-03	8,23E-06	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

Parameter	Unit	A1-A3	A4 alt 1	A4 alt 2	A5-1	A5-2
HW	KG	3,37E-03	5,37E-04	5,74E-04	1,85E-06	0,00E+00
NHW	KG	2,98E-01	3,23E-01	3,67E-01	4,72E-04	0,00E+00
RW	KG	6,90E-05	1,68E-05	1,90E-05	7,04E-08	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 alt 1	A4 alt 2	A5-1	A5-2
CR	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
MR	kg	0,00E+00	0,00E+00	0,00E+00	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

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

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	0,0005

Additional Norwegian requirements

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

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(A3).

National electricity grid	Unit	Value
Electricity, Estonian production mix, with import, medium voltage, Econinvent v3.8	kg CO2 -eq/kWh	0,937

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 instantanious oxidation. GWP-IOBC is also reffered to as GWP-GHG in context to Swedish public procurement legislation.

Indicator	Unit	A1-A3	A4 alt 1	A4 alt 2	A5-1	A5-2
GWP-IOBC	kg CO2 eq.	2,21E+00	1,75E-01	1,96E-01	6,27E-04	3,86E-01

GWP-IOBC *Global warming potential calculated according to the principle of instantanious 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 or the Norwegian priority list. The product is classified as hazardous waste (Avfallsforskiften, Annex III), see table.

Name	CAS no.	Amount
Ammonium Nitrate	6484-52-2	60-80%
Sodium Nitrate	7631-99-4	5 - <10%
Destillates (petroleum)	64742-53-6	1 - <2.5%
Thiourea	62-56-6	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+A2:2019	Sustainability of construction works - Environmental product declaration - Core rules for the product category of construction products
SimaPro	LCA software, developed by PRé Sustainability
NPCR PART A Ver 2	Construction Products and Services
NPCR 024 2021 ver. 2.0	Explosives and Initiation Systems
Bjordal, Kristine, 2023	LCA Report for Senatel Powerfrag by Orica

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