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The Norwegian EPD Foundation

ENVIRONMENTAL PRODUCT DECLARATION

in accordance with ISO 14025, ISO 21930 and EN 15804

Owner of the declaration:	Oy Forcit Ab
Program operator:	The Norwegian EPD Foundation
Publisher:	The Norwegian EPD Foundation
Declaration number:	NEPD-2256-1033-EN
Registration number:	NEPD-2256-1033-EN
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Issue date:	16.06.2020
Valid to:	16.06.2025

Kemiitti 810

(produced in Vihtavuori, Finland)

Oy Forcit Ab

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General information

Product:
Kemiitti 810
(produced in Vihtavuori, Finland)

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Declaration number:
NEPD-2256-1033-EN

Place of production:
Vihtavuori, Finland

ECO Platform reference number:
-

Management system:
ISO 9001, ISO 14001

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

Organisation no:
0103189-6

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:
16.06.2020

Valid to:
16.06.2025

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

Year of study:
LCA was conducted between May 2019 and February 2020. Production data represents year 2018.

Comparability:
EPDs of construction products may not be comparable if they do not comply with EN 15804 and are not seen in a building context. A comparison of explosives, detonators and initiation systems must be based on scenarios with comparable technical specifications.

Declared unit with option:
A1-3, A4 and A5

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

The EPD has been worked out by:
Emma Salminen
LCA Consulting Oy

LCA Consulting

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:
Alexander Borg
Alexander Borg, Asplan Viak AS
(Independent verifier approved by EPD Norway)

Approved
Håkon Hauan
Managing Director of EPD-Norway

Product

Product description:
Kemiitti 810 is a bulk emulsion explosive used for underground excavations, tunnelling and mining.

Kemiitti 810 consists of two semi-finished components; matrix and gassing agent. Both components are produced at Forcit factory in Vihtavuori, Finland. The semi-finished components (matrix and gassing agent) are transported to customer sites where the finished bulk emulsion explosive is manufactured and charged into boreholes by use of mobile underground charging units.

Product specification:
Energy content of Kemiitti 810: 3.0 MJ/kg

Materials	%
Ammonium nitrate	70-85
Lubricating oils (petroleum), C20-C50, hydrotreated neutral oilbased	3-6

Technical data:
1 kg of bulk explosive.

EC-type examination certificates:
CE0589 (BAM, Germany), PvTT 095/02

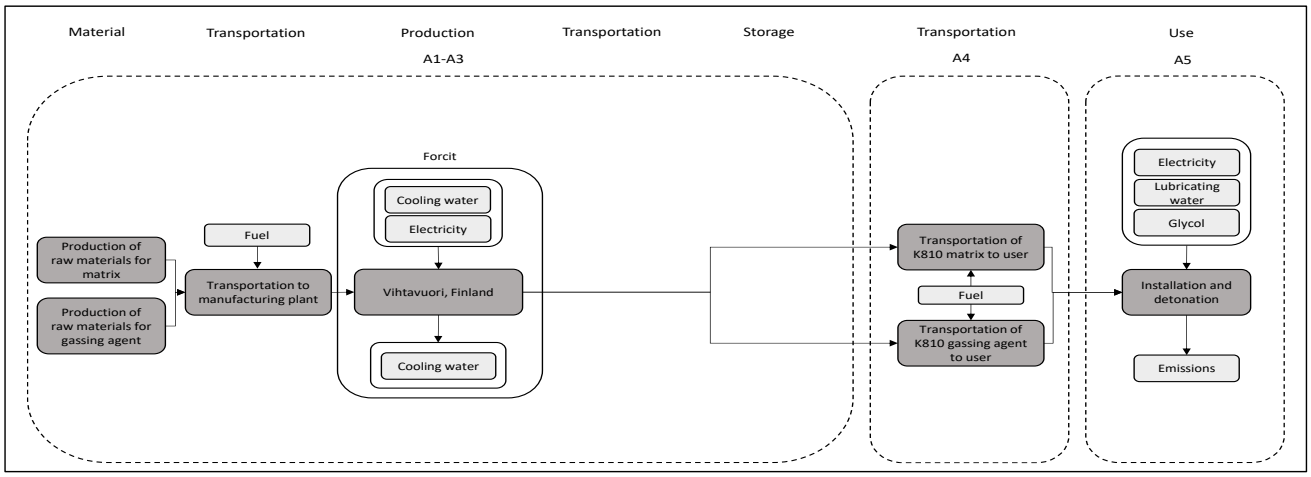
Market:
Nordic Countries (Finland, Sweden, Norway)

Reference service life, product:
Reference service life is not relevant to Explosives. Explosives are used only once.

LCA: Calculation rules

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

System boundary:
Flow chart is presented below. The main unit processes of each life cycle stage are presented in the dark grey boxes. The main background processes and detonation emissions are presented in the light grey boxes.



Data quality:
Specific data is used to model A4 transportation, detonation stage and production operations at Vihtavuori production plant. Specific data represent year 2018. Locations of raw material suppliers and A2 transportation of raw materials are partly modelled based on specific data.

Generic data is used to model the production of raw materials, energy etc. (background processes). Generic data is mainly from Gabi Professional database. Ecoinvent database and literature sources are also used to fill data gaps. Characterization factors are based on EN 15804:2012. Ozone depletion potential result is deemed the most uncertain of the assessed environmental impact results due to the usage of secondary data that includes CFCs.

Data used is not older than 10 years.

Cut-off criteria:
All major raw material and energy inputs are included. Production processes of specific raw materials and energy flows that are used in minor quantities (<1% of total mass input or energy use of a unit process) are not included in the assessment. This cut-off rule does not apply for hazardous materials and substances.

Allocation:
Allocation is conducted in accordance with the provisions of EN 15804. Energy and water inputs, and municipal waste generated are allocated equally among all products manufactured at the production plant through mass allocation. Influence of primary production of a recycled material is allocated to the main product for which the material was used. The recycling process and transportation of the material is allocated to this analysis.

LCA: Scenarios and additional technical information

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

Gassing agent and matrix of Kemiitti 810 are produced in Vihtavuori, Finland. Gassing agent is transported in IBC-containers to the users. Kemiitti 810 matrix is transported straight to the users in a tanker truck. Final users of Kemiitti 810 are normally located in Finland.

Matrix and gassing agent are combined, and lubricating water is added in A5-1 stage on user site. Glycol is used in wintertime for frost protection. The detonation emissions are calculated based on balanced chemical reaction at final stage and in 1 bar. The key calculating values related to A2 (internal transportation), A4, A5-1 and A5-2 stages are presented in tables below.

Transport from production plant to user (A4)

Type	Capacity utilization (incl. return) %	Type of vehicle	Distance km	Fuel consumption	Value
Gassing agent - truck	100	EURO 5 truck	735*	l/tkm	0,02
Matrix - Tanker truck	50	Truck	1470**	l/tkm	0,03

*One-way distance is applied since other cargo are transported on a return trip.
** Transportation distance is from production plant to user, including return trip.

Installation stage of explosive (A5-1)

	Unit	Value
Product	kg	1
Electricity	kWh	0,02
Glycol*	kg	0,00095
Lubricating water	kg	0,02

* Used only in wintertime for frost protection.

Detonation stage of explosive (A5-2)

Emission to air	Unit	Value
Carbon	kg	0
Methane	kg	0
Carbon dioxide	kg	0,132
Water	kg	0,563
Nitrogen	kg	0,277
Sodium carbonate	kg	0
Carbon monoxide*	kg	0,022

* Formed in secondary reactions.

LCA: Results

Life cycle stages A1-A5 are included. The environmental impact results and LCI results related to inputs and outpust are presented per declared unit (1 kg of manufactured, installed and detonated product). Results are calculated according to the EN 15804:2012 requirements.

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	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	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND

Environmental impact

Parameter	Unit	A1-3	A4	A5-1	A5-2
GWP	kg CO_2 -eq.	9,96E-01	1,23E-01	4,31E-03	1,32E-01
ODP	kg CFC11-eq.	3,47E-09	3,05E-17	1,88E-17	0,00E+00
POCP	kg C_2H_4 -eq.	1,07E-04	-1,00E-04	1,25E-06	5,94E-04
AP	kg SO_2 -eq.	1,27E-03	3,00E-04	1,28E-05	0,00E+00
EP	kg PO_4^{3-}-eq.	3,53E-04	7,21E-05	1,42E-06	1,16E-01
ADPM	kg Sb-eq.	1,23E-07	9,98E-09	8,93E-10	0,00E+00
ADPE	MJ	1,59E+01	1,66E+00	7,05E-02	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

*NO has negative impact on POCP impact category. In GaBi modelling, NOx emissions of transportation are divided to NO and NO2 emissions which leads to negative emissions in A4 stage (i.e. NO emissions of transportation cause negative emissions).

Resource use

Parameter	Unit	A1-3	A4	A5-1	A5-2
RPEE	MJ	5,72E-01	9,93E-02	5,89E-02	0,00E+00
RPEM	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00
TPE	MJ	5,72E-01	9,93E-02	5,89E-02	0,00E+00
NRPE	MJ	1,49E+01	1,67E+00	1,39E-01	0,00E+00
NRPM	MJ	1,52E+00	0,00E+00	0,00E+00	0,00E+00
TRPE	MJ	1,65E+01	1,67E+00	1,39E-01	0,00E+00
SM	kg	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
NRSF	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00
W	m^3	1,52E-03	1,67E-04	1,12E-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 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
HW	kg	1,24E-08	9,28E-08	1,16E-10	0,00E+00
NHW	kg	1,97E-03	1,41E-04	9,93E-05	0,00E+00
RW	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00

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
CR	kg	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
MER	kg	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
ETE	MJ	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

Greenhouse gas emissions from electricity use in the manufacturing phase

Basic Finnish grid mix electricity is used in Vihtavuori production plant. Electricity production is modelled with Gabi Professional database. All the necessary background data is included. Country specific individual characteristics are considered. Data represents year 2016.

Data source	Amount	Unit
Vihtavuori: Gabi Professional database. Electricity grid mix, FIN.	0,174	kg CO_2-eq./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, Annex III), see table.

Name	CAS no.	Amount
Ammonium nitrite	6484-52-2	70-85%
Lubricating oils (petroleum), C20-C50, hydrotreated neutral oilbased	72623-87-1	3-6%

Indoor environment

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

Carbon footprint

Carbon footprint has not been worked out for the product.

Bibliography

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ISO 14044:2006	*Environmental management - Life cycle assessment - Requirements and guidelines*
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thinkstep. 2016.	*Gabi Professional database.*
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ISO 9001:2015	*Quality management systems — Requirements.*

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