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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-2250-1032-EN
Registration number:	NEPD-2250-1032-EN
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Issue date:	16.06.2020
Valid to:	16.06.2025

Fordyn / Austroge F

Oy Forcit Ab

www.epd-norge.no



General information

Product:

Fordyn / Austrogel F

Program operator:

The Norwegian EPD Foundation
P.O. Box 5250 Majorstuen, N-0303 Oslo Norway
Phone: +47 977 22 020
e-mail: post@epd-norge.no

Declaration number:

NEPD-2250-1032-EN

ECO Platform reference number:

-

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

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.

Declared unit:

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

Declared unit with option:

A1-3, A4 and A5

Functional unit:

Declared unit is applied instead on functional unit.

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)

Owner of the declaration:

Oy Forcit Ab
Contact person: Veera Wiinamäki
Phone: +358 207 440 217
e-mail: veera.wiinamaki@forcit.fi

Manufacturer:

Oy Forcit Ab
Forcintie 37, 10900 Hanko, Finland
Phone: +358 207 440 400
e-mail: forcit@forcit.fi

Place of production:

Hanko, Finland

Management system:

ISO 9001, ISO 14001

Organisation no:

0103189-6

Issue date:

16.06.2020

Valid to:

16.06.2025

Year of study:

LCA was conducted between May 2019 and February 2020.
Production data represents year 2018 and 2019 for energy usage.

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.

The EPD has been worked out by:

Emma Salminen
LCA Consulting Oy




Approved



Håkon Hauan
Managing Director of EPD-Norway

Product

Product description:

Fordyn/Austrogel F (henceforth referred as Fordyn) is a packed explosive (dynamite) used in bench, trench and underwater blasting.

Fordyn is produced and packed at Hanko production plant in Finland. Finished explosives are transported by truck to Forciti's warehouses and further to the final user sites.

Product specification:

Energy content of Fordyn: 4.4 MJ/kg

Materials	%
Ammonium nitrate	50-60
Ethylene dinitrate	30-35
Nitrocelluloce	<2
Plasticizer	1-3

Technical data:

1 kg of packed explosive.

EC-type examination certificates:
CE0589 (BAM, Germany), 0589.EXP.2332/18

Market:

Nordic Countries (Finland, Sweden, Norway)

Reference service life, product:

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

Package (mass 0,07 kg/kg of Fordyn)	%
Plastic film	0-50
PE-coated paper	0-50
Aluminium wire	<1
Automation stripe	<1
Cardboard box	50-52

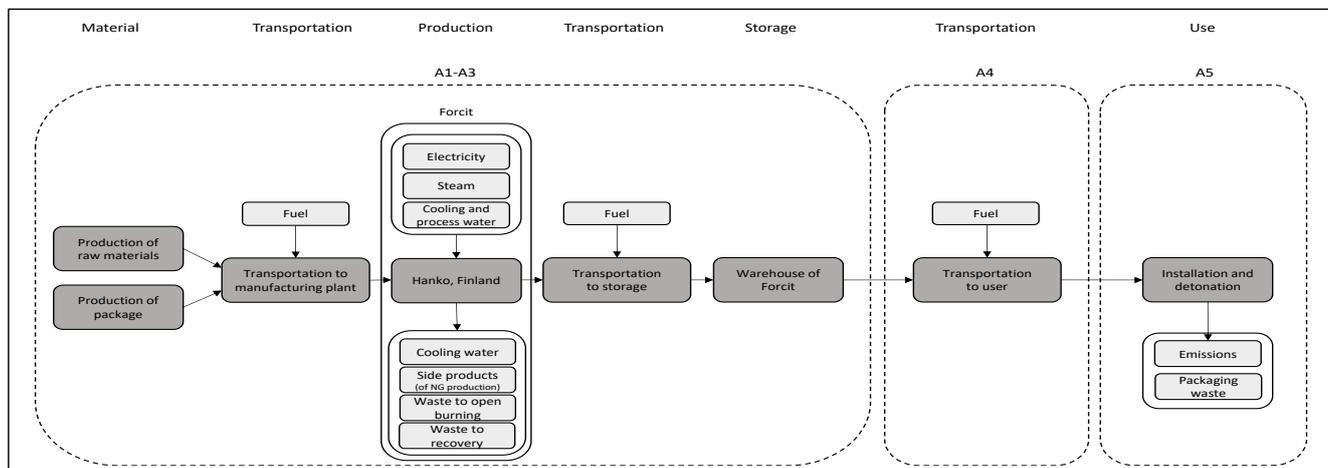
LCA: Calculation rules

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 Hanko plant. Specific data represent years 2018 and 2019. 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 Hanko 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.

Fordyn is produced at Hanko production plant in Finland. The finalized products are packed in either PE-coated paper or plastic film, depending on the product dimension. The products are transported to customers in cardboard boxes via Forcitr's warehouses. In calculation it is assumed that both the storage and final users of the product are located in Finland.

No auxiliary materials or substances are used in the installation (A5-1) stage. The detonation emissions are calculated based on balanced chemical reaction at final stage and in 1 bar.

The key calculating values related to A4, A5-1 and A5-2 stages are presented in tables below.

Transportation from production plant to storage (A2 internal transportation)

Type	Capacity utilization (incl. return) %	Type of vehicle	Distance* km	Fuel consumption	Value
Truck	100	EURO 5 truck	152	l/tkm	0,02

*One-way distance is applied since other cargo is transported.

Transport from storage to user (A4)

Type	Capacity utilization (incl. return) %	Type of vehicle	Distance** km	Fuel consumption	Value
Delivery van	50	Delivery van	80	l/tkm	0,13

** Transportation distance is from storage to user, including return trip.

Installation stage of explosive (A5-1)

	Unit	Value
Product	kg	1

No auxiliary materials or substances are needed on installation stage. Fordyn is a ready-to-use product when entering the user site.

Detonation stage of explosive (A5-2)

Emission to air	Unit	Value
Carbon	kg	0
Methane	kg	0
Carbon dioxide	kg	0,293
Water	kg	0,358
Nitrogen	kg	0,275
Sodium carbonate	kg	0
Nitrogen monoxide*	kg	0,002
Oxygen*	kg	0,043

* Formed in secondary reactions.

LCA: Results

Life cycle stages A1-A5 are included. The environmental impact results and LCI results related to inputs and output 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			Assembly 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.	1,01E+00	2,91E-02	5,84E-02	2,93E-01
ODP	kg CFC11-eq.	7,53E-09	8,10E-18	1,39E-17	0,00E+00
POCP*	kg C ₂ H ₄ -eq.	1,85E-04	5,10E-06	3,90E-07	-8,54E-04
AP	kg SO ₂ -eqv	2,97E-03	5,92E-05	1,27E-05	1,52E-03
EP	kg PO ₄ ³⁻ -eq.	6,09E-04	1,37E-05	2,51E-06	1,16E-01
ADPM	kg Sb-eq.	9,15E-07	2,65E-09	2,02E-10	0,00E+00
ADPE	MJ	1,69E+01	4,41E-01	2,16E-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. NO is formed in detonation stage.

Resource use

Parameter	Unit	A1-3	A4	A5-1	A5-2
RPEE	MJ	2,61E+00	2,63E-02	3,52E-03	0,00E+00
RPEM	MJ	1,05E+00	0,00E+00	0,00E+00	0,00E+00
TPE	MJ	3,66E+00	2,63E-02	3,52E-03	0,00E+00
NRPE	MJ	1,76E+01	4,43E-01	2,44E-02	0,00E+00
NRPM	MJ	5,96E-01	0,00E+00	0,00E+00	0,00E+00
TRPE	MJ	1,82E+01	4,43E-01	2,44E-02	0,00E+00
SM	kg	1,68E-01	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	2,57E-02	4,44E-05	1,69E-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	5,42E-08	2,46E-08	3,59E-10	0,00E+00
NHW	kg	1,03E-02	3,74E-05	1,78E-03	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	1,45E+00	0,00E+00	0,00E+00	0,00E+00
MR	kg	1,74E-02	0,00E+00	0,00E+00	0,00E+00
MER	kg	4,62E-03	0,00E+00	4,04E-02	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: $9,0 \text{ E-03} = 9,0 \cdot 10^{-3} = 0,009$

Additional Norwegian requirements

Greenhouse gas emissions from electricity use in the manufacturing phase

Electricity used at Hanko production plant is modelled with basic grid mix electricity dataset. Average electricity grid mix of Finland 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
Gabi Professional database. Electricity grid mix of Finland.	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 (Avfallsforskriften, Annex III), see table.

Name	CAS no.	Amount
Ammonium nitrate	6484-52-2	50-60%
Ethylene dinitrate	628-96-6	30-35%
Nitrocellulose	603-037-00-6	<2%
Plasticizer	102-76-1	1-3%

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

ISO 14025:2010	<i>Environmental labels and declarations - Type III environmental declarations - Principles and procedures</i>
ISO 14044:2006	<i>Environmental management - Life cycle assessment - Requirements and guidelines</i>
EN 15804:2012+A1:2013	<i>Sustainability of construction works - Environmental product declaration - Core rules for the product category of construction products</i>
ISO 21930:2007	<i>Sustainability in building construction - Environmental declaration of building products</i>
The Norwegian EPD Foundation. 2016.	<i>Product-category rules, NPCR 024 version 1.0, Explosives and Initiation Systems.</i>
LCA Consulting Oy. 2020.	<i>LCA Study Report. Oy Forciti Ab products. Forprime 25, Fordyn, Offshore Kemiitti, Kemiitti 810, Kemiitti 510, Kemiitti 610, Kemix A. Report version 1.1.</i>
thinkstep. 2016.	<i>Gabi Professional datadase.</i>
ISO 14001:2015	<i>Environmental management systems — Requirements with guidance for use.</i>
ISO 9001:2015	<i>Quality management systems — Requirements.</i>

 epd-norge.no The Norwegian EPD Foundation	Program operator The Norwegian EPD Foundation Post Box 5250 Majorstuen, 0303 Oslo Norway	Phone: +47 97722020 e-mail: post@epd-norge.no web: www.epd-norge.no
 epd-norge.no The Norwegian EPD Foundation	Publisher The Norwegian EPD Foundation Post Box 5250 Majorstuen, 0303 Oslo Norway	Phone: +47 97722020 e-mail: post@epd-norge.no web: www.epd-norge.no
 FORCIT EXPLOSIVES	Owner of the declaration Oy Forciti Ab Veera Wiinamäki Forcintie 37, 10900 Hanko, Finland	Phone: +358 20 744 0400 Fax: e-mail: forcit@forcit.fi web: www.forcit.fi
 LCA CONSULTING	Author of the Life Cycle Assessment LCA Consulting Oy Emma Salminen Laserkatu 6, 53850 Lappeenranta, Finland	Phone: +358 40 762 5800 Fax: e-mail: info@lca-consulting.fi web: www.LCA-consulting.fi