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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 |
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Kemiitti 810

(produced in Karlskoga, Sweden)

Oy Forcit Ab

www.epd-norge.no



General information

Product:

Kemiitti 810
(produced in Karlskoga, Sweden)

Program operator:

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Declaration number:

NEPD-2254-1032-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)

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:

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Manufacturer:

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Place of production:

Karlskoga, Sweden

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.

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:

Kemiitti 810 is a bulk emulsion explosive used for underground excavations, tunnelling and mining. Kemiitti 810 consist of two semi-finished components: matrix and gassing agent. Gassing agent is prepared in Forciti's factory in Gällivare and matrix is produced in Forciti factory in Karlskoga, Sweden. The semi-finished components (matrix and gassing agent) are transported to customer site 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.

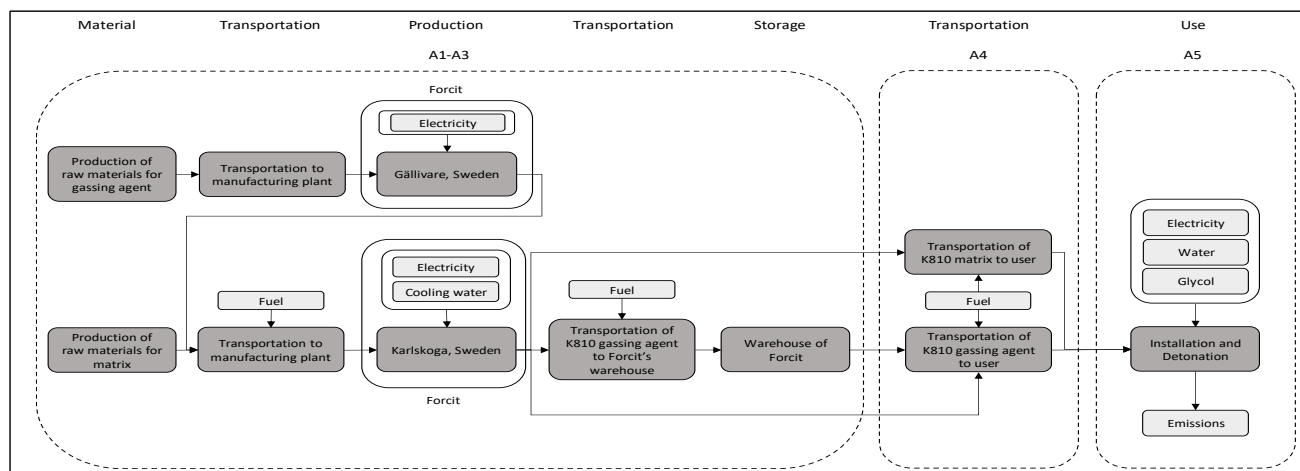
LCA: Calculation rules

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 Karlskoga and Gällivare plants. 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 of Kemiitti 810 is produced in Gällivare, Sweden. It is transported to the users in IBC-containers via Karlskoga, Sweden and Forcit's warehouses. Kemiitti 810 matrix is produced in Karlskoga and it is transported to user in a tanker truck. Forcit's warehouses and the final users of Kemiitti 810 are normally located in Sweden and Norway.

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.

Transportation from production plant to Karlskoga and then to warehouse of Forcit (A2 internal transportation)

| Type | Capacity utilization (incl. return) | Type of vehicle | Distance km | Fuel consumption | Value |
|-----------------------|-------------------------------------|-----------------|-------------|------------------|-------|
| Gassing agent - Truck | 50 | EURO 5 truck | 1229* | l/tkm | 0,03 |
| Gassing agent - Truck | 50 | EURO 5 truck | 420** | l/tkm | 0,03 |

*One-way distance is applied since other cargo are transported on a return trip.

**Including the also the return trip.

Transport from storage/production plant to user (A4)

| Type | Capacity utilization (incl. return) % | Type of vehicle | Distance km | Fuel consumption | Value |
|-----------------------|---------------------------------------|-----------------|-------------|------------------|-------|
| Matrix - Tanker truck | 49 | Truck | 500** | l/tkm | 0,03 |
| Gassing agent - Truck | 50 | EURO 5 truck | 20** | l/tkm | 0,04 |

** Transportation distance is from storage 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 reaction

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. | 1,04E+00 | 4,69E-02 | 1,56E-03 | 1,32E-01 |
| ODP | kg CFC11-eq. | 5,23E-09 | 1,17E-17 | 3,08E-17 | 0,00E+00 |
| POCP* | kg C ₂ H ₄ -eq. | 9,36E-05 | -4,25E-05 | 6,50E-07 | 5,94E-04 |
| AP | kg SO ₂ -eq. | 1,49E-03 | 1,23E-04 | 4,01E-06 | 0,00E+00 |
| EP | kg PO ₄ ³⁻ -eq. | 4,11E-04 | 2,98E-05 | 7,06E-07 | 1,16E-01 |
| ADPM | kg Sb-eq. | 1,61E-07 | 3,81E-09 | 1,18E-09 | 0,00E+00 |
| ADPE | MJ | 1,66E+01 | 6,36E-01 | 3,85E-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, NO_x 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 | 6,64E-01 | 3,80E-02 | 7,51E-02 | 0,00E+00 |
| RPEM | MJ | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| TPE | MJ | 6,64E-01 | 3,80E-02 | 7,51E-02 | 0,00E+00 |
| NRPE | MJ | 1,57E+01 | 6,39E-01 | 1,06E-01 | 0,00E+00 |
| NRPM | MJ | 1,52E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| TRPE | MJ | 1,72E+01 | 6,39E-01 | 1,06E-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 | 1,86E-03 | 6,39E-05 | 1,52E-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 | 3,73E-08 | 3,55E-08 | 4,60E-11 | 0,00E+00 |
| NHW | kg | 1,78E-03 | 5,38E-05 | 1,06E-04 | 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: $9,0 \text{ E-03} = 9,0 \cdot 10^{-3} = 0,009$

Additional Norwegian requirements

Greenhouse gas emissions from electricity use in the manufacturing phase

Electricity used at Karlskoga and Gällivare production plants is modelled with basic grid mix electricity dataset. 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 |
|--|--------|-----------------------------|
| Gabi Professional database. Electricity grid mix, SWE. | 0,037 | 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 (Avfallsforskiten, 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 | <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> |
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| ISO 14001:2015 | <i>Environmental management systems — Requirements with guidance for use.</i> |
| ISO 9001:2015 | <i>Quality management systems — Requirements.</i> |

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