

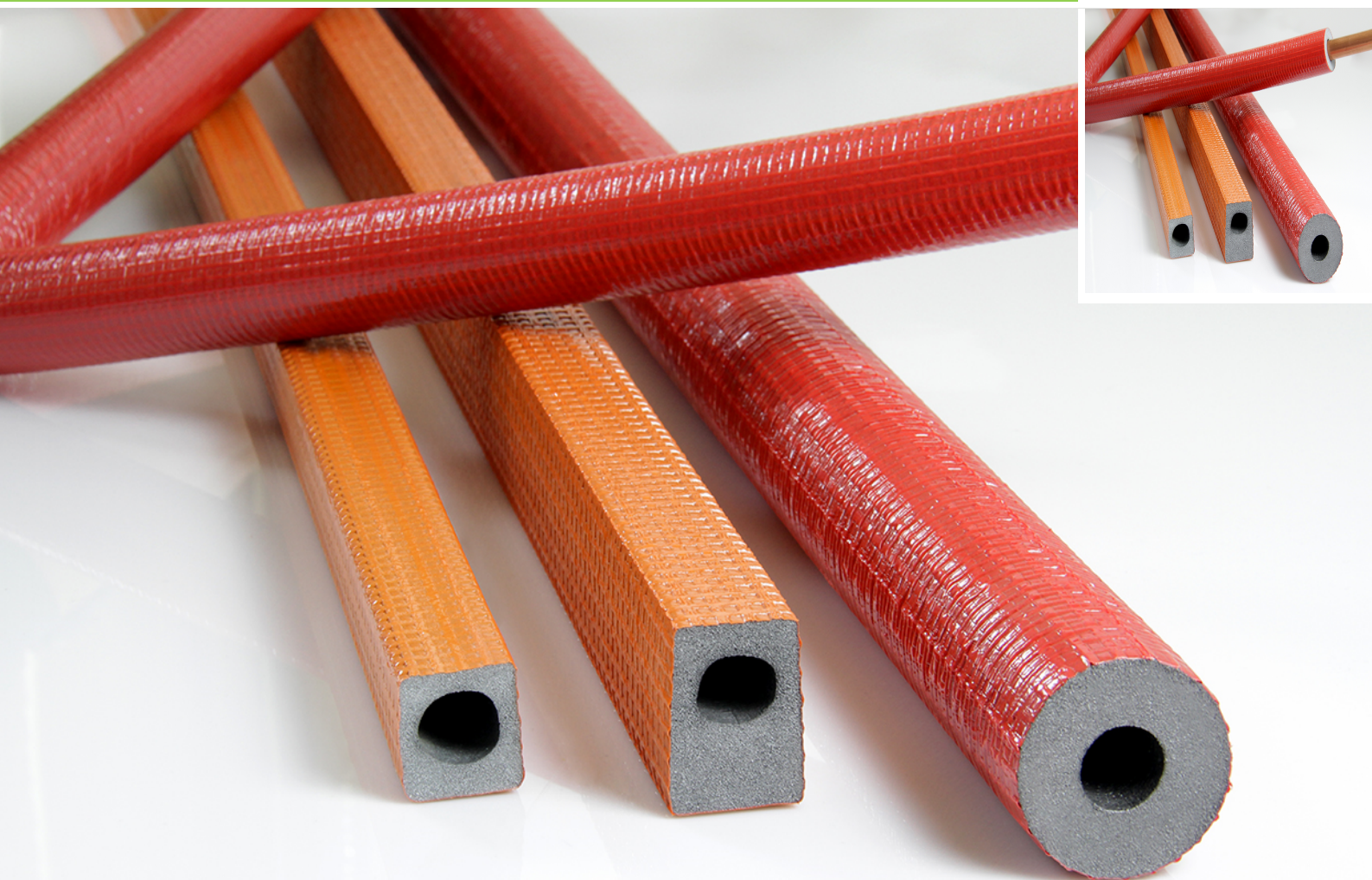
ENVIRONMENTAL PRODUCT DECLARATION

as per ISO 14025 and EN 15804

| | |
|--------------------------|--------------------------------------|
| Owner of the Declaration | NMC S.A. |
| Programme holder | Institut Bauen und Umwelt e.V. (IBU) |
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| Issue date | 07.09.2017 |
| Valid to | 06.09.2022 |

CLIMAFLEX® STABIL / EXENTROFLEX® COMPACT made
of NMC NATUREFOAM®
NMC S.A.

www.ibu-epd.com / <https://epd-online.com>



1. General Information

NMC S.A.

Programme holder

IBU - Institut Bauen und Umwelt e.V.
Panoramastr. 1
10178 Berlin
Germany

Declaration number

EPD-NMC-20170102-IBD1-EN

This Declaration is based on the Product Category Rules:

Insulating materials made of foam plastics, 12.2016
(PCR tested and approved by the SVR)

Issue date

07.09.2017

Valid to

06.09.2022



Prof. Dr.-Ing. Horst J. Bossenmayer
(President of Institut Bauen und Umwelt e.V.)



Dr. Burkhard Lehmann
(Managing Director IBU)

CLIMAFLEX® STABIL / EXZENTROFLEX® COMPACT made of NMC NATUREFOAM®

Owner of the Declaration

NMC S.A.
Gert-Noel Strasse
BE-4731 Eynatten

Declared product / Declared unit

1 m³ insulation material CLIMAFLEX® STABIL /
EXZENTROFLEX® COMPACT made of NMC
NATUREFOAM®

Scope:

Product line CLIMAFLEX® STABIL /
EXZENTROFLEX® COMPACT made of NMC
NATUREFOAM®

Thermal insulation products for building equipment and industrial insulations made of Polyethylene-based, closed-cell foam pipe insulation with a robust protective coating (PEF) according to /EN14313/. This declaration is an Environmental Product Declaration according to /ISO14025/ describing the specific environmental performance of the product produced in Belgium. The only difference between the two CLIMAFLEX® STABIL made of NMC NATUREFOAM® and EXZENTROFLEX® COMPACT made of NMC NATUREFOAM® is the shape chemically they are identical. CLIMAFLEX® STABIL made of NMC NATUREFOAM® has a circular shape while EXZENTROFLEX® COMPACT NMC NATUREFOAM® is rectangular and thus more suitable for the insulation of heating pipes in a concrete floor

The owner of the declaration shall be liable for the underlying information and evidence; the IBU shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.

Verification

The CEN Norm /EN 15804/ serves as the core PCR

Independent verification of the declaration
according to /ISO 14025/

☐ internally ☒ externally



Vito D'Incognito
(Independent verifier appointed by SVR)

2. Product

2.1 Product description / Product definition

CLIMAFLEX® STABIL / EXZENTROFLEX® COMPACT made of NMC NATUREFOAM® is the Professional Polyethylene-based closed-cell foam pipe insulation with a robust PE protective coating for continuous energy saving and condensation control purposes. CLIMAFLEX® STABIL NMC NATUREFOAM® provides solutions that follow all necessary guidelines for any type of installation. EXZENTROFLEX® COMPACT NMC NATUREFOAM® With its rectangular and thin design, it is used in flooring.

For the placing on the market of the product in the EU/EFTA (with the exception of Switzerland) Regulation (EU) No. 305/2011 /CPR/ applies. The product needs a Declaration of Performance taking into consideration /EN 14313 : 2015/ Thermal Insulation products for building equipment and industrial installations. Factory made polyethylene foam (PEF) and the CE-marking. For the application and use the respective national provisions apply.



2.2 Application

CLIMAFLEX® STABIL made of NMC NATUREFOAM® is used to insulate pipes for heating and plumbing. EXZENTROFLEX® COMPACT made of NMC NATUREFOAM® is used in flooring

- Polyethylene foam is a cost-efficient material with good insulating properties.
- Products made of PE foam yield an excellent cost/performance ratio.
- Heat loss control and noise reduction in fresh- and waste water and heating systems

2.3 Technical Data

| Name | Value | Unit |
|---|---------------------|-------------------|
| Gross density | 30.8 | kg/m ³ |
| Thermal conductivity | 0.04 - 0.042 | W/(m K) |
| Reaction to fire acc.to /EN 13501-1/ | E | - |
| Max Service Temperature acc. To /EN14706/, /EN 14707 | 100 | °C |
| Min Service Temperature | 0 | °C |
| Water absorption acc. to /EN 13472/ | WS005 | |
| Traces quantities of water soluble ions and pH-value acc. to /EN 13468/ | CL15 - F10 - pH 5.5 | |

2.4 Delivery status

The PE products are supplied as, tubes. The tubes are delivered in lengths of 2 m packed in cardboard boxes. The insulating sleeves in the CLIMAFLEX® STABIL/ EXZENTROFLEX® COMPACT made of NMC NATUREFOAM® have a thickness ranging from 4 to 51mm and an inside diameter ranging from 12 to 42mm. These products are categorized according to thermal conductivity (Lambda*). The category of product with lambda 0,040 (W/(mK)) (acc. to /EN ISO 8497/ and /EN 12667/) includes the CLIMAFLEX®STABIL with thicknesses of 4, 9, 13, 20 and 25mm and EXZENTROFLEX® COMPACT with thickness 9, while the category of product with lambda 0,042 (W/(mK)) (acc. to /EN 12667/) includes EXZENTROFLEX®COMPACT with thicknesses from 25 to 51mm products.

2.5 Base materials / Ancillary materials

Base materials

CLIMAFLEX® STABIL / EXZENTROFLEX® COMPACT made of NMC NATUREFOAM® is a flexible insulation material based on Polyethylene with a protecting coating of PE., which consists of around 8 basic components. The following table displays the different elements of formula.

| Name | Value | Unit |
|------------------------------|-------|------|
| BIO LDPE | 58,6 | % |
| NMC internally recycled LDPE | 25,8 | % |
| Flame retardent | 3,3 | % |
| Nucleating | 0,7 | % |
| Pigment color | 0,9 | % |
| Pigment 2 | 1,7 | % |

| | | |
|-------------------|-----|---|
| Volume stabilizer | 0,9 | % |
| LLDPE | 1,8 | % |
| Blowing Agent | 6,3 | % |

PE and fillers give the aspect of the product. The blowing agent causes the expansion during manufacturing. And the flame retardants ensure the fire resistance. According the European Chemicals Regulation /REACH/ Manufacturers, importers and downstream users must register their chemicals and are responsible for their safe use on their own. For its production NMC S.A. uses exclusively verifiably registered and approved substances. Products manufactured and put on the market by NMC need to be registered. CLIMAFLEX® STABIL / EXZENTROFLEX®COMPACT made of NMC NATUREFOAM® does not contain SVHC substances

2.6 Manufacture

The manufacturing process consists of a continuous extrusion. Solid pellets of thermoplastic resin are fed to a melting zone in which the resin is melted, to form a flowable thermoplastic mass. The thermoplastic mass is then metered to a mixing zone where the thermoplastic mass is thoroughly mixed with a blowing agent under pressure. The mixture of thermoplastic resin and blowing agent is then forced through a die, which imparts a shape to the thermoplastic mass, into a zone of lower pressure, such as atmospheric pressure. The blowing agent expands to form the cells of the foam and the thermoplastic foam is cooled trough an inline water cooler. The protection coating "skin" is applied by co-extrusion. The "skin" is made with solid pellets of thermoplastic resin and some additives, which is, with the help of an extruder, applied around the foam. There's no a foaming agent used in this case. The die is positioned around the "naked" foam and deposes a small thickness (± 0.1 mm) of PE film on the foam. At the end of this process the profiles are cut at dimension.

Quality assurance :

The manufacture is certified /ISO 9001/ for the quality management. The product corresponds to the product standard /EN 14313/ and have a Declaration of Performance according the /CPR/ : DOP n° W1PEF300 ; W1PEF400 (see www.nmc.eu/dop)

2.7 Environment and health during manufacturing

During all manufacturing steps of NMC S.A. Belgium , the production follows the national guidelines and regulations. Solar panels are installed on the roof of the warehouses

2.8 Product processing/Installation

CLIMAFLEX® STABIL / EXZENTROFLEX® COMPACT made of NMC NATUREFOAM® can be installed using basic tools like knives. No special tools, or specific protection is necessary. When applying adhesives the information given in the relevant safety data sheets is to be heeded. The recommendations how to use the product is described in the application manuals or video's. More details are listed on the Web Page www.nmc.eu

2.9 Packaging

CLIMAFLEX® STABIL / EXZENTROFLEX® COMPACT made of NMC NATUREFOAM® products are packed in



cardboard boxes and transported on reusable pallets. The packaging material can be recycled.

2.10 Condition of use

During the use of the product for the purpose for which they are intended, there are no modifications on the product during the use, except if due to and extraordinary impact (see point 2.13)

2.11 Environment and health during use

There are no particular aspects of the material composition during the use. The CLIMAFLEX® STABIL / EXZENTROFLEX® COMPACT made of NMC NATUREFOAM® products are used in a wide range and varieties of applications for which the product is intended to. The PEF foams fulfil the German, Belgian and French regulations regarding the emission of VOC with emissions far below the most severe limit values. The Eurofin Product Testing institute, on the demand of the CEFEP (European group of PEF and FEF manufacturers) has made a wide range of tests for different PEF products from different manufacturers.

The insulation of heating pipes with CLIMAFLEX® STABIL / EXZENTROFLEX® COMPACT made of NMC NATUREFOAM® allows a drastic reduction of CO₂ emission during the full service life of the installation. The quantification of this is not in the topic of this EPD, and have to be evaluated in the frame of the LCA from the complete installation

2.12 Reference service life

The function of CLIMAFLEX® STABIL/EXZENTROFLEX® COMPACT made of NMC NATUREFOAM® is to insure the insulation of heating and sanitary installations for a reference service life (RSL) of 50 years. This duration is based on the frequency of replacement of sanitary and heating piping in buildings. Although the insulation products are still effective after 50 years, it is assumed that when replacing the piping, the insulation (CLIMAFLEX® STABIL/EXZENTROFLEX® COMPACT made of NMC NATUREFOAM®) is not reused and is disposed of with the piping. 50 years is the minimum Reference Service Life recommended in /prEN16783/.

2.13 Extraordinary effects

Fire

According to EN13501-1 CLIMAFLEX® STABIL / EXZENTROFLEX® COMPACT made of NMC NATUREFOAM® are classified as EURO CLASS E and therefore have a limited speed of inflammation.

Fire Protection

| Name | Value |
|-------------------------|-------|
| Building material class | E |

Water

CLIMAFLEX® STABIL / EXZENTROFLEX® COMPACT made of NMC NATUREFOAM® are closed cell foam and obtain the better water absorption class WS005 according to the product standard

Mechanical destruction

CLIMAFLEX® STABIL / EXZENTROFLEX® COMPACT made of NMC NATUREFOAM® are flexible foam covered with a PE protective coating CLIMAFLEX® STABIL / EXZENTROFLEX® COMPACT made of NMC NATUREFOAM® are not UV resistant. The use is not recommended for outside applications without complementary UV protection

2.14 Re-use phase

In principle, if removed carefully, CLIMAFLEX® STABIL / EXZENTROFLEX® COMPACT made of NMC NATUREFOAM® can be reused on any other piping system of similar dimensions. Any material not suitable for reuse is fully recyclable.

2.15 Disposal

CLIMAFLEX® STABIL / EXZENTROFLEX® COMPACT made of NMC NATUREFOAM® are fully recyclable using the same recycling systems as those used for other forms of PE waste.

Any non-recycled material should be disposed of the materials according to the local regulations, and by the /European Waste Catalogue/ (<http://www.wastesupport.co.uk/ewc-codes/>) waste code 07 02 13 waste Plastic "Low Density Polyethylene"

2.16 Further information

Additional information about CLIMAFLEX® STABIL / EXZENTROFLEX® COMPACT made of NMC NATUREFOAM® can be found on the NMC web Site www.nmc.eu. Here specification clauses, data sheets and application manuals can be found

3. LCA: Calculation rules

3.1 Declared Unit

The declaration refers to 1 m³ of installed insulation product. For the LCA calculations, as the product is foam and have some tolerances, the density declared is the average between the product categories. The thermal conductivity coefficient (Lambda-value) and R-value per 25 mm thickness per product brand is provided below as additional information and support for installers.

Declared unit

| Name | Value | Unit |
|-------------------|--------------------------------|-------------------|
| Declared unit | 1 | m ³ |
| Gross density | 30.8 | kg/m ³ |
| Volume for 1kg | 0.032467 | kg |
| Conversion factor | Section of the insulation pipe | |

| | | |
|---|-------------------|--|
| from 1m ³ to 1 meter | (m ²) | |
| Thermal Conductivity λ: 0.040 W/mK at (40°C) | | |
| R-value- thickness: 25 mm: +/- 3,5 (m ² K)/W | | |
| Thermal Conductivity λ: 0.042 W/mK at (40°C) | | |
| R-value- thickness: 25 mm: +/- 3,355 (m ² K)/W | | |
| depending of the pipe diameter. | | |

3.2 System boundary

The Data collection refers to the yearly production in 2016. The cycle stages A1 to C4 are considered :

Module A1 to A3: The LCA calculation covers the production of the raw materials, transport of these to the plant, the mixing of raw materials according to the respective recipes, manufacturing of the foam product and packaging for dispatch. All production takes place exclusively in Eynatten, Belgium.

Module A4: Transport of the final product to the application site. The average transport distance has been calculated based on a weighted value for NMC's main customers representing more than 50% of the sales volume in 2016. Capacity utilisation by volume is 100%. However, given the low density of the product, capacity utilisation by mass has been estimated as 10%.

Module A5: Installation of CLIMAFLEX®STABIL EXZENTROFLEX®COMPACT products is done by hand and requires no special equipment apart from a knife. The products can be placed end to end and the remaining pieces can be reused on other pipes.

Module B1 to B5: Use phase. Although the insulation of the piping can contribute to large reductions in the environmental impact of heating and cooling equipment, this is not taken into account here. Any such calculation, should usually consider the complete installation or take place at the building level. As foam insulation products do not require maintenance, replacement or refurbishment over the 50 year - reference service life, there are no impacts in modules B1 to B5.

Module C1 to C4: Removal and end-of-life. Disassembly, transport and landfill are taken into consideration. Credits for electric and thermal energy resulting from the waste incineration process of the off-cut material and packaging (A5) and product (C3) are declared in module D.

3.3 Estimates and assumptions

Module A2:

The loading factor for trucks is estimated to be 50%. This is based on a fully-loaded outbound journey and an empty return.

Module A5:

For installation, we taken into consideration a default waste percentage of 2 % for insulation materials of this type based on guidance provided by /prEN 16783/. It is assumed that this 2% installation waste is landfilled. Cardboard packaging waste is assumed to be 90.1% recycled with the remainder going to landfill. This is based on paper packaging disposal statistics for the European Union 27 countries.

Module B1:

we consider the reference service life to be 50 years, based on the recommendation in /prEN 16783/.

Module A5 and C2:

The average distance between the installation site and waste treatment/waste disposal (landfill) is estimated to be 100 km.

The scenario that has been retained for this Life Cycle Assessment is the most realistic and it's the 100% Landfill

3.4 Cut-off criteria

Any glue and adhesive tapes used during the installation (A5) have not been included as quantification of these materials is uncertain and their use by the various installers is too diverse, adhesives

and glues are not required in all/most cases, but may be used for some applications. In this study no others cut-off criteria have been applied and all elementary incoming processes as well as all energy and water inputs and waste outputs have been counted.

3.5 Background data

The software system for life cycle engineering GaBi 7 developed by Thinkstep AG was used to perform this LCA. The GaBi LCI database /GaBi 7/ provides the life cycle inventory data for several of the raw and process materials obtained from the background system. The most recent update of the database was in 2016.

3.6 Data quality

All the foreground data requiring such energy or raw material coming from production, were verified and cross-checked before being included in the model. Most of the life cycle inventories for the basic materials are available in the GaBi 7 database. The last update of the database was 2016. Further LCIs for materials of the supply chain of the raw materials were approximated with LCIs of similar materials or estimated by the combination of available LCIs. For electrical and thermal energy regional specific grid mixes and regional specific supply for natural gas were considered.

3.7 Period under review

The production data for the year 2016 were used for the realisation of this study.

3.8 Allocation

There is no co-product or by-product generated during the production of NMC's products.

Production waste

Any production waste from the process (machine start, end of production, non-conforming products, etc.) is recycled internally in order to be reused in the manufacturing process. These impacts are accounted for in A1-A3.

Installation and End-of-Life waste

During the installation phase (Module A5), a default waste percentage of 2% is taken into consideration. This construction waste is considered to be landfilled. Cardboard packaging on site is considered to be recycled at 90,1% the rest being sent to Landfill. The scenario that has been retained for this Life Cycle Assessment is the most realistic and it's the 100% Landfill.

3.9 Comparability

Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to /EN 15804/ and the building context, respectively the product-specific characteristics of performance, are taken into account. The used background database has to be mentioned.

4. LCA: Scenarios and additional technical information

Transport to the building site (A4)

| Name | Value | Unit |
|---------------------------------------|-------|---------|
| Litres of fuel | 0.523 | l/100km |
| Transport distance | 458 | km |
| Capacity utilisation (including empty | 10 | % |

| | | |
|---------------------------------------|------|-------------------|
| runs) | | |
| Gross density of products transported | 30.8 | kg/m ³ |
| Capacity utilisation volume factor | 0.5 | - |

Installation into the building (A5)

| Name | Value | Unit |
|------|-------|------|
|------|-------|------|



| | | |
|---|-------|----|
| Material loss in percent | 2 | % |
| Output substances following waste treatment on site | 13.91 | kg |

Reference service life

| Name | Value | Unit |
|------------------------|-------|------|
| Reference service life | 50 | a |

End of life (C1-C4)

| Name | Value | Unit |
|-------------|-------|------|
| Landfilling | 30.8 | kg |

5. LCA: Results

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE NOT DECLARED)

| PRODUCT STAGE | | | CONSTRUCTION PROCESS STAGE | | USE STAGE | | | | | | | END OF LIFE STAGE | | | | BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARIES |
|---------------------|-----------|---------------|-------------------------------------|----------|-----------|-------------|--------|-------------|---------------|------------------------|-----------------------|----------------------------|-----------|------------------|----------|---|
| Raw material supply | Transport | Manufacturing | Transport from the gate to the site | 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 | X | X | X | X |

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT: CLIMAFLEX® STABIL / EXZENTROFLEX® COMPACT made of NMC NATUREFOAM®/M³

| Parameter | Unit | A1-A3 | A4 | A5 | C2 | C3 | C4 | D |
|-----------|---|---------|----------|----------|----------|---------|----------|---------|
| GWP | [kg CO ₂ -Eq.] | -21.50 | 7.01 | 1.60 | 0.28 | 0.00 | 2.99 | 0.00 |
| ODP | [kg CFC11-Eq.] | 1.06E-7 | 5.70E-12 | 3.89E-13 | 2.31E-13 | 0.00E+0 | 7.35E-12 | 0.00E+0 |
| AP | [kg SO ₂ -Eq.] | 1.25E+0 | 3.32E-2 | 5.81E-4 | 1.25E-3 | 0.00E+0 | 8.26E-3 | 0.00E+0 |
| EP | [kg (PO ₄) ³ -Eq.] | 8.81E-1 | 8.33E-3 | 6.95E-4 | 3.12E-4 | 0.00E+0 | 8.19E-3 | 0.00E+0 |
| POCP | [kg ethene-Eq.] | 2.49E-1 | -1.37E-2 | 4.01E-4 | -5.07E-4 | 0.00E+0 | 9.43E-4 | 0.00E+0 |
| ADPE | [kg Sb-Eq.] | 4.80E-2 | 6.33E-7 | 3.28E-8 | 2.57E-8 | 0.00E+0 | 6.19E-7 | 0.00E+0 |
| ADPF | [MJ] | 726.33 | 96.66 | 2.27 | 3.92 | 0.00 | 42.88 | 0.00 |

Caption: GWP = Global warming potential; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential of land and water; EP = Eutrophication potential; POCP = Formation potential of tropospheric ozone photochemical oxidants; ADPE = Abiotic depletion potential for non-fossil resources; ADPF = Abiotic depletion potential for fossil resources

RESULTS OF THE LCA - RESOURCE USE: CLIMAFLEX® STABIL / EXZENTROFLEX® COMPACT made of NMC NATUREFOAM®/M³

| Parameter | Unit | A1-A3 | A4 | A5 | C2 | C3 | C4 | D |
|-----------|------|---------|-------|------|------|------|-------|------|
| PERE | [MJ] | 1972.28 | 4.99 | 0.17 | 0.20 | 0.00 | 3.27 | 0.00 |
| PERM | [MJ] | 1526.26 | IND | IND | IND | IND | IND | IND |
| PERT | [MJ] | 3498.54 | 4.99 | 0.17 | 0.20 | 0.00 | 3.27 | 0.00 |
| PENRE | [MJ] | 1161.57 | 97.17 | 2.36 | 3.94 | 0.00 | 44.60 | 0.00 |
| PENRM | [MJ] | 157.05 | IND | IND | IND | IND | IND | IND |
| PENRT | [MJ] | 1318.62 | 97.17 | 2.36 | 3.94 | 0.00 | 44.60 | 0.00 |
| SM | [kg] | IND | IND | IND | IND | IND | IND | IND |
| RSF | [MJ] | IND | IND | IND | IND | IND | IND | IND |
| NRSF | [MJ] | IND | IND | IND | IND | IND | IND | IND |
| FW | [m³] | 387.50 | 9.23 | 0.19 | 0.37 | 0.00 | 0.11 | 0.00 |

| | |
|---------|---|
| Caption | PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used as raw materials; PENRT = Total use of non-renewable primary energy resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water |
|---------|---|

RESULTS OF THE LCA – OUTPUT FLOWS AND WASTE CATEGORIES:

CLIMAFLEX® STABIL / EXZENTROFLEX® COMPACT made of NMC NATUREFOAM®/M³

| Parameter | Unit | A1-A3 | A4 | A5 | C2 | C3 | C4 | D |
|-----------|------|---------|---------|---------|---------|---------|---------|---------|
| HWD | [kg] | 6.41E-4 | 5.07E-6 | 9.14E-9 | 2.05E-7 | 0.00E+0 | 1.72E-7 | 0.00E+0 |
| NHWD | [kg] | 1.08E+1 | 7.69E-3 | 1.85E+0 | 3.12E-4 | 0.00E+0 | 4.17E+1 | 0.00E+0 |
| RWD | [kg] | 1.71E-1 | 2.01E-4 | 3.58E-5 | 8.14E-6 | 0.00E+0 | 6.76E-4 | 0.00E+0 |
| CRU | [kg] | IND | IND | IND | IND | IND | IND | IND |
| MFR | [kg] | IND | IND | IND | IND | IND | IND | IND |
| MER | [kg] | IND | IND | IND | IND | IND | IND | IND |
| EEE | [MJ] | IND | IND | IND | IND | IND | IND | IND |
| EET | [MJ] | IND | IND | IND | IND | IND | IND | IND |

| | |
|---------|---|
| Caption | HWD = Hazardous waste disposed; NHWD = Non-hazardous waste disposed; RWD = Radioactive waste disposed; CRU = Components for re-use; MFR = Materials for recycling; MER = Materials for energy recovery; EEE = Exported electrical energy; EEE = Exported thermal energy |
|---------|---|

6. LCA: Interpretation

The most interesting fact regarding the use of NMC NATUREFOAM® in the manufacture of CLIMAFLEX® STABIL / EXZENTROFLEX® COMPACT made by NMC NATUREFOAM® is that the product put on the market (after steps A1-A3) contributes to the reduction

of global warming potential (**GWP** -21,5 Kg CO₂-Eq./m³).

The base polymer used by NMC is produced from vegetable matter (biomass). This biomass, absorbs atmospheric carbon during the growth phase. In this

way 3,61KG of biogenic carbon are stored per kg of Bio-ethanol. The emissions during the production of bio-polyethylene, (biomass production + bio-ethanol production + bio-ethylene production + polymerization) are 1, 46 CO₂-eq./Kg bio-polyethylene. The global production of the bio-polyethylene, from production of the biomass to the final granulate polymer, has consequently a negative GWP impact with a value of - 3,61 (stored) + 1,46 (reemitted) = -2,15 CO₂-eq./Kg bio-polyethylene.

The average quantity of bio-polyethylene used in composition of CLIMAFLEX®STABIL EXZENTROFLEX®COMPACT is 26,25kg/m³ foam. This give as factory input a value of -2.15 x 26.25 = - 56,4kg CO₂-eq (carbon biogenic) from bio polyethylene per m³ foam. The impact of materials, transport, electricity and fuels are equal to 34,9Kg CO₂-eq./m³ which gives this overall value of -21,5kg CO₂-Eq./m³ (carbon biogenic) for module A1-A3 aggregate.

The end-of-life scenario modeled is 100% to landfill. It is for this reason that the carbon reemitted is very low (2,991kg CO₂-Eq./m³) in module C4 compared to for example, energy recovery. However, there are also no benefits beyond the system boundary. As bio PE-LD does not degrade in landfill, there are no biogenic CO₂ emissions from landfill and effectively the landfill acts as a carbon sink.

With regards to the other impact categories such as acidification potential (AP), eutrophication potential (EP), photochemical ozone creation potential (POCP) etc. the most impacting modules of the LCA are the modules A1 to A3 and more particularly the raw material supply.

Steps that have contribute most significantly to the impact on global warming potential are steps A2 (transport), A4 (transport) and also C4 (disposal). Due to the low density of the final product, A4 (transport) has a comparatively high GWP (7,01 kg CO₂-Eq./m³). The impact of the assembly stage (A5) is relatively small, as installation is manual and does not require any additional inputs.

The value for primary energy demand results mostly from renewable resources due to the use of bio-based polyethylene rather than fossil-based polyethylene. An improvement path to further improve the impact of CLIMAFLEX® STABIL / EXZENTROFLEX® COMPACT made by NMC NATUREFOAM® would be to reuse or recycling 100% of CLIMAFLEX® STABIL / EXZENTROFLEX® COMPACT made by NMC NATUREFOAM® rather than put on Landfill the material at end of life. From a resource perspective, landfill should also be avoided.

The use of bio-polyethylene for the manufacture of CLIMAFLEX® STABIL / EXZENTROFLEX® COMPACT made by NMC NATUREFOAM® makes it possible to obtain a value below 0 with regard to global warming potential. Electricity consumption is the main source of emissions during manufacturing. One of the solutions to continue to improve the assessment of CLIMAFLEX® STABIL / EXZENTROFLEX® COMPACT made by NMC NATUREFOAM® would be to modify the sources of electrical supply. For example, by increasing the photovoltaic power installed at the NMC s.a. site or by finding suppliers that produce electricity from more renewable energy sources.

7. Requisite evidence

7.1. VOC emissions

Eurofins Product Testing A/S has tested a wide range and variety of typical PEF (Polyethylene foam) products marketed in the EU from CEFEP (European Group of PEF/FEF manufacturers) Based on the loading factor 0.05m²/m³ (determined after consideration of the real life applications of PEF products (in living rooms) and recommendations by the experts of the test institute) all results were found to be clearly below the limit values. For all samples below 100mg/m³ TVOC after 28 days. Certificates are available on request.

7.1 VOC emissions

For products used in indoor applications. Test procedure to /AgBB/diagramme indicating the measuring agency, date and results as a range of values. At least the following must be declared: According to /EN 13468/ is the content of water-soluble chloride ions CLIMAFLEX® STABIL / EXZENTROFLEX® COMPACT <15mg/kg

8. References

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Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Project Report
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Gabi ts

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