

**Muumi Baby diapers carbon footprint
report based on standard ISO
14067:2018**

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1. Delipap

Delipap is a Finnish family business that develops, manufactures, markets and sells hygiene products for the needs of the whole family. Delipap is the only manufacturer in Finland that develops disposable feminine hygiene products and children's diapers. Delipap considers environmental responsibility throughout the life cycle of its products, from the selection of raw materials to their disposal. Delipap's products have also been awarded the Nordic Swan Ecolabel.

Delipap wants to be clear about the greenhouse gas emissions of its products throughout their life cycle and has now, together with Clonet Oy, determined the carbon footprint of Muumi Baby diaper products.

2. Definition of carbon footprint

The carbon footprint describes the climate load caused by a specific delimitable entity – in this case Delipap's individual diaper products. Climate pollution is caused by emissions of greenhouse gases such as carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O). The carbon footprint is expressed as carbon dioxide equivalents, which takes into account the different climate-warming effects of different greenhouse gases. When determining the carbon footprint, all direct and indirect emissions related to a certain entity during its life cycle are taken into account. For the product, the carbon footprint is determined per selected unit.

The carbon footprint is reported as the mass of emissions generated, in the case of diaper products it is reported in grams (g).

Determining the carbon footprint of Delipap's diaper products is based on the ISO 14067:2018 product carbon footprint standard which is the national standard of Finland. The standard defines the principles, requirements and instructions related to the determination and reporting of the product's carbon footprint (CFP, Carbon Footprint of Product). The standard is based on the life cycle calculation standards ISO 14040 and 14044, but only focuses on one impact category, i.e. climate change. The standard does not take a position on carbon footprint related communication or compensations for emissions.

When determining the carbon footprint of Delipap's diaper products a systematic approach in line with standard ISO 14067:2018 appendix C was used. This way the carbon footprints of all different sizes and types of diaper products are calculated using the same processes, limitations, allocating processes and data, including assumptions regarding usage and disposal.

The systematic approach is based on applying the newest iteration (EPD, 2020) of product category rules of absorbent hygiene products.

Calculation was done with OpenCO₂.net platform's carbon footprint calculator.

3. Defining the goals and scope of the calculation

The goal and scope of the calculation

The goal of the calculation was to determine the carbon footprint for ten of Delipap's diaper products. The results can be applied to different product development areas, for example designing the procurement channels or choosing materials. The results also work as a good basis if Delipap decides to compensate their emissions.

Table 1. Delipap's Muumi Baby diaper products included in the calculation

PRODUCT NAME AND SIZE OF PACKAGING	PRODUCT CODE	WEIGHT (g/pcs) *)
MUUMI BABY 1 - 25 PCS, diaper	58705	22,4
MUUMI BABY 2 - 58 PCS, diaper	58715	23,8
MUUMI BABY 3 - 50 PCS, diaper	58725	30,5
MUUMI BABY 4 - 46 PCS, diaper	58735	36,4
MUUMI BABY 5 - 44 PCS, diaper	58745	36,4

MUUMI BABY 6 - 36 PCS, diaper	58755	41,8
MUUMI BABY WALKERS 4-40 PCS, pant diaper	59205	37,2
MUUMI BABY WALKERS 5-38 PCS, pant diaper	59690	37,3
MUUMI BABY WALKERS 6-36 PCS, pant diaper	59425	37,3
MUUMI BABY WALKERS 7-34 PCS, pant diaper	59515	39,0

*) Here the displayed weight also includes the product's packaging and the packaging for transportation.

Functional unit

In this calculation a functional unit is one diaper product and all the results displayed are per one unit.

Delimitation

The calculation includes all product stages from cradle to grave. In the case of disposable diaper products, the usage stage is not relevant as it is very short, and the products are disposed immediately after use. Because of this the usage stage has been left out of the calculation (*EPD, 2020*).

The product stages included in the calculation are divided to the following three groups:

Upstream processes before production (cradle-to-gate)

- Mining and refining of materials
- Packaging production
- Upstream processes of energy production
- Production of raw materials

Core processes (gate-to-gate)

- Transportation of the raw materials used in production
- Manufacturing of products (includes processing of raw materials, cutting, shaping, gluing and packaging of finished products)
- Production of electricity used for manufacturing
- Handling of the waste generated during production

Downstream processes after production (gate-to-grave)

- Transportation of products to the average customer (retailer or distributor)
- Waste handling of used products and packaging

In addition to the usage phase the following is left out of the calculation:

- Manufacturing of machines and equipment, buildings and other production assets
- Business travelling of the staff
- Staff's commute to work and back
- Research and development
- Pallets

Transports from the wholesaler to individual retailers and from retailers to the consumer have also been excluded from the calculation, because no reliable information on transport modes and distances was available. The system boundary used in the calculation is shown in Figure 1.

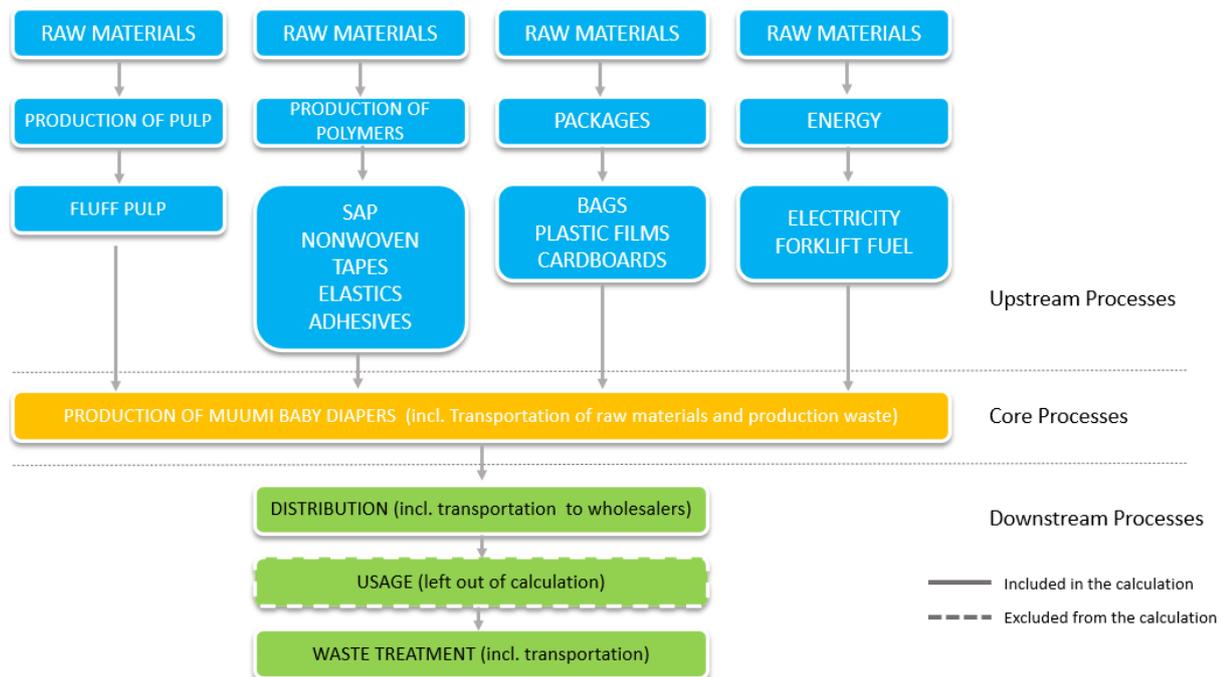


Figure 1. Delimitation of the system included in the calculation

In terms of core processes, the geographical delimitation applies to the Tammissaari production plant, where Delipap's Muumi Baby diaper products are manufactured. The usage and disposal of the products is limited to Finland, so the downstream processes cover the territory of Finland.

The calculation includes all of the raw materials used in manufacturing of the products (e.g., pulp, films, nonwovens, superabsorbents and glues), so the coverage of the calculation is 100%.

Defective products i.e., diaper products that go to waste, are taken into account in the calculation.

Data and its requirements

In the calculation, primary data must be used when available. If primary data was not available, secondary data has been used for upstream and downstream processes.

The following emission factor statistics, which are considered relevant in Finland, were used in the calculation:

- [OpenCO2.net](https://openco2.net/) platform's emission database
- Transportation: VTT (Technical research centre of Finland), Lipasto database
- Plastics: Plastics Europe
- Waste treatment: Tilastokeskus (national authority for collecting and compiling statistics on various fields of society and economy), waste statistics

In addition, EcoInvent 3.7 database was used for comparison.

Diapers are classified as municipal waste. They are instructed to be disposed of together with mixed waste, from which they are diverted to energy recovery or to a small extent to landfills (landfill disposal of organic waste is prohibited by the landfill ordinance). According to Finland's

waste statistics, in 2018 energy recovery accounted for 99% and landfill disposal accounted for 1% of mixed waste (Tilastokeskus, 2020). When calculating these percentages, material recovery, composting and putrefaction of mixed waste (the combined share of which was less than 2% of the total amount of mixed waste) were left out of the calculation, because these waste treatment methods are not suitable for diaper waste.

Diaper products are packed in biodegradable* plastic packaging and plastic transport packaging. Packaging plastics are instructed to be recycled, but currently their recycling rate in Finland is 27.5% (Finland's Ministry of Economic Affairs and Employment TEM, 2019). The remaining packaging plastics end up in energy recovery.

Temporal limitation of data

The production data used in the calculation are from 2019.

Assumptions, especially regarding the use and disposal of the products

The usage phase is excluded from the calculation and the waste treatment methods are assumed to be in line with Finland's average waste treatment methods for mixed waste (diapers) and plastics (packaging).

* From September 2022 onwards the products are packed in 25% recycled PE plastic packages to further reduce CO2 emissions. New carbon footprint report will be available in 2023 containing revised calculations based on the material change.

4. Life Cycle Inventory (LCI)

Unit processes included in the calculation

The calculation includes all unit processes included in the delimitation.

Upstream processes:

- Manufacturing of the packaging materials
- The effects during the life cycle of energy production
- Manufacturing of the raw materials used

Core processes:

- Transportation of raw materials from their suppliers to the Tammisaari factory
- Energy consumption during product manufacturing at the Tammisaari factory
- Waste generated from the diaper production

Downstream processes:

- Transportation of the diapers to the wholesalers
- Waste treatment of the diapers and packaging (incl. transportation)

Greenhouse emissions included in the calculation

In addition to carbon dioxide emissions (CO₂), the calculation includes methane (CH₄) and nitrous oxide (N₂O) emissions from raw materials and transportation to the extent the information was available. The calculation uses characterization factors with a time span of 100 years.

Initial data used in the calculation and its validation

The calculation was carried out from the initial data provided by Delipap. The initial data and emission factor data obtained from suppliers was compared with data obtained from public sources in order to assess their reliability. In other respects, previously mentioned reliable sources have been used.

The effect of delimitation on the end result

The effect of the emission sources that were excluded from the calculation was evaluated with the help of sensitivity reviews and it was established that the calculation covers 99% of the emissions.

Allocation procedures

Since the Tammissaari production plant produces several different diaper products, allocation cannot be completely avoided. The allocation has been made on a mass basis.

Specific greenhouse gas emissions and sinks (removals), e.g. LUC (Land Use Change)

The biogenic emissions of diaper products were not included in the calculation because carbon binds to the products only for a short time and is released into the atmosphere when the diapers are disposed of by burning.

Emissions caused by the production of electricity purchased by Delipap have been calculated based on supplier-specific data. The electricity used at the factory is hydropower electricity with a certified origin.

Based on the information received from suppliers, there are no emission sources related to land use change and land use.

Emissions from air travel and other business travel have not been included in the calculation in accordance with the guidelines of the PCR document (EPD, 2020).

5. Life cycle impact assessment (LCIA)

Calculation results

The carbon footprint calculations for each product were done with a carbon footprint counter on the OpenCO2.net platform. A summary of the results is shown in the following table.

Table 2. Summary of the carbon footprint calculation of Delipap's Muumi Baby diapers (g CO₂ekv. /pcs including emissions from fossil sources)

PRODUCT NAME AND SIZE OF PACKAGING	UP-STREAM	CORE PROCESSES	CRADLE-TO-GATE	DOWN-STREAM	TOTAL (g CO ₂ ekv./pcs)
MUUMI BABY 1 25 PCS, diaper	40,1	3,19	43,3	8,95	52,2
MUUMI BABY 2 58 PCS, diaper	44,8	3,66	48,4	9,93	58,4
MUUMI BABY 3 50 PCS, diaper	54,9	4,63	59,6	12,5	72,0

MUUMI BABY 4 46 PCS, diaper	62,6	5,51	68,1	15,0	83,1
MUUMI BABY 5 44 PCS, diaper	62,5	5,46	67,9	15,0	82,9
MUUMI BABY 6 36 PCS, tape diaper	70,7	6,44	77,1	17,3	94,4
MUUMI BABY WALKERS 4 40 PCS, pant diaper	63,9	4,93	68,9	15,9	84,7
MUUMI BABY WALKERS 5 38 PCS, pant diaper	63,5	5,05	68,6	15,8	84,4
MUUMI BABY WALKERS 6 36 PCS, pant diaper	63,5	5,05	68,5	15,9	84,4
MUUMI BABY WALKERS 7 34 PCS, pant diaper	66,8	5,30	72,1	16,6	88,7

Impact assessment of biogenic emissions

The biogenic emissions of diaper products are excluded from the calculation, because the bio-based carbon dioxide bound to diaper products is released when the diapers are disposed of by burning. However, the magnitude of biogenic emissions was estimated using a sensitivity analysis.

The supplier provided information regarding the amount of biogenic carbon dioxide bound to the raw material, pulp, which is the most significant bio-based raw material used in the production of diapers. Based on this, the amount of carbon dioxide bound to diaper products has been estimated to be -11.8...-28.0 g/piece depending on the diaper size (23.1...26.6% of emissions from fossil sources).

6. Interpretation of the results

The most significant emission sources

The most significant emission source of Muumi Baby diaper products is the manufacturing of the materials and raw materials used in them. The next most significant emission source is the disposal of diapers (incineration of mixed waste).

The emissions of Delipap's own operations are low because the electricity used is hydropower and part of the waste generated during production is recycled. All remaining production waste is burned for energy.

Calculation's completeness, consistency and sensitivity checks

All significant emission sources have been included in the calculation, and based on the performed sensitivity analyses, the calculation includes 99% of the emissions during the life cycle of diaper products.

Although reliable sources for emission factors have been used in the calculation, the emission factor information of secondary data is subject to uncertainty. The reliability of the calculation can be further improved if the proportion of primary data can be increased. When using secondary data, the emission factors have been chosen in compliance with the precautionary principle, so it is likely that the emissions have been estimated to be too high in some respects.

7. Critical evaluation

The calculation has been carried out following the guidelines of the ISO 14067:2018 standard and the guidelines of the PCR document (EPD, 2020) have been taken into account. The use of the PCR document has been approved by EPD International AB.

The calculations were carried out with the carbon footprint calculator of the OpenCO2.net platform and its calculation methods and formulas have been extensively tested.

The calculation was carried out by DSC, eMBA Sari Siitonen, who has long experience in sustainable development and emission calculation. Delipap's expert team has checked the calculations (DI Oskari Nuortie, Engineer Kirsi Heiskanen and MBA Emilia Nordström).

Sources:

[EPD, 2020, PCR, Absorbent Hygiene Products, 2011:14 Version 3.0, The International EPD® System \(Date 2020-02-11\)](#). Permission to use the document was received from EPD International AB on April 22, 2020.

[ISO 14067:2018 -standardi: Greenhouse gases — Carbon footprint of products — Requirements and guidelines for quantification](#)

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