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## LDPE and LLDPE foils



### Owner of the EPD:

WARTER POLYMERS Sp. z o.o.  
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ITB is the verified member of The European Platform for EPD program operators and LCA practitioner [www.eco-platform.org](http://www.eco-platform.org)

### Basic information

This declaration is the Type III Environmental Product Declaration (EPD) based on EN 15804+A2 and verified according to ISO 14025 by an external auditor. It contains the information on the impacts of the declared construction materials on the environment. Their aspects were verified by the independent body according to ISO 14025. Basically, a comparison or evaluation of EPD data is possible only if all the compared data were created according to EN 15804+A2.

**Life cycle analysis (LCA):** A1-A3, C1-C4 and D modules in accordance with EN 15804+A2 (Cradle-to-Gate with options)

**The year of preparing the EPD:** 2024

**Service Life:** > 25 years

**Product standard:** EN 13967:2012, EN 13984:2013, EN 14909:2012

**PCR:** ITB-PCR A

**Declared unit:** 1 kg

**Reasons for performing LCA:** B2B

**Representativeness:** Polish, European

## **MANUFACTURER**

WARTER POLYMERS Sp. z o. o. was established as a result of separation of fast growing Plastic Products Division, which was part of OBR S.A. company, and as a consequence creation an independent economic unit. Its long-term practice in plastic products branch in connection with modern machine park, well qualified staff, advanced research and development facility allow WARTER POLYMERS Sp. z o. o. to deliver high quality products.

Thanks to the convenient location in the central Poland, in Płock – „the capital of Polish Chemical Industry”, WARTER POLYMERS Sp. z o. o. has excellent access to the best materials. Additionally, the efficiently functioning national distribution network allows to quick realization of customer orders. The Quality Management System is compliant with PN-EN ISO 9001:2015 and PN-EN ISO 14001:2015.



Fig. 1. A view of the WARTER POLYMERS Sp. z o.o. production plant located in Płock (Poland)

## **PRODUCTS DESCRIPTION AND APPLICATION**

LDPE and LLDPE foils are intended for various applications resulting from the physical and mechanical properties of the product. LDPE foil is one of the most popular polymer materials with a wide range of applications in industry. It is made of low density polyethylene (LDPE = Low Density Polyethylene, LLDPE = Linear Low Density Polyethylene).

LDPE low-density polyethylene foils produced by WARTER POLYMERS Sp. z o. o. are used in construction, agriculture and gardening. In construction, intended for horizontal moisture insulation of walls, foundations and building walls. In agriculture, for covering tunnel structures - widely used to cover crops in agriculture, horticulture and forestry. The use of agriculture foils accelerates plant growth and significantly increases crop productivity, while providing protection against the harmful

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effects of UV radiation and other weather factors. These foils are also used to cover formed piles of plants intended for silage for animal feeding. WARTER POLYMERS Sp. z o. o. foils are also used in the construction of swimming pools.

Scope of application:

- insulation of waterproofing elements of buildings in contact with the ground,
- roof insulation,
- damp proofing in buildings,
- vapour control layer,
- silage foil,
- packaging foil,
- sealing in small water reservoirs (garden pools, ponds),
- fluid barrier in the construction of tunnels and underground structures,
- fluid and/or gas barrier in the construction of liquid waste disposal sites, transfer stations and secondary containment,
- fluid and/or gas barrier in the construction of solid waste storage and disposal sites,
- fluid barrier in the construction of reservoirs and dams,
- fluid barrier in the construction of canals,
- fluid barrier in transportation infrastructure and others.



Fig. 2. LDPE AND LLDPE foils production hall WARTER POLYMERS Sp. z o.o. in Płock.

More information about LDPE and LLDPE foils can be found on WARTER POLYMERS Sp. z o.o. website [www.warterpolymers.pl](http://www.warterpolymers.pl)

### **Declared Unit**

The declaration refers to declared unit (DU) - 1 kg of product of LDPE and LLDPE foils.

### **Allocation**

The allocation rules used for this EPD are based on general ITB-PCR A v. 1.6. Production of LDPE and LLDPE foils is a line process (Fig. 3) conducted in the factory of WARTER POLYMERS Sp. z o. o., located in Płock (Poland). Allocation was done on product mass basis.

All impacts from raw materials extraction and processing are allocated in module A1 of the LCA. Impacts from the on-site line production WARTER POLYMERS Sp. z o. o. were inventoried and 54 % were allocated to the production of LDPE AND LLDPE foils based on the annual production volume expressed in kg. Water and energy consumption, associated emissions and generated wastes are allocated to module A3. Packaging materials were taken into consideration.

The obtained results are representative average for all LDPE AND LLDPE foils produced in different thicknesses at the Płock production plant.

### **System limits**

The life cycle analysis (LCA) of the declared products covers: product stage – modules A1-A3, end of life – modules C1-C4 and benefits and loads beyond the system boundary – module D (cradle-to-gate with options) in accordance with EN 15804+A2 and ITB PCR A, v. 1.6. All materials and energy consumption inventoried in factory were included in calculation. Office impacts were also taken into consideration. In the assessment, all significant parameters from gathered production data were inventoried and were included in the calculations, i.e. all material used per formulation, utilised thermal energy, internal fuel and electric power consumption, direct production waste, water consumption and all available emission measurements.

It can be assumed that the total sum of omitted processes does not exceed 5% of all impact categories. In accordance with EN 15804+A2, machines and facilities (capital goods) required for the production as well as transportation of employees were not included in LCA.

### **Modules A1 and A2: *Raw materials supply and transport***

LDPE and LLDPE granulates, regranulates, dyes, colouring concentrates and others additives used to produce LDPE and LLDPE foils and packaging materials come from local and external suppliers. Raw materials come from Polish and international suppliers. Data on transport of the different products to the manufacturing plant is collected and modelled for factory by assessor. Means of transport include big trucks (>16 t) are applied. Based on data provided by the manufacturer, all input of transport resources was inventoried in details.

### **Module A3: *Production***

The production is done by WARTER POLYMERS Sp. z o. o. plants in Płock, Poland. A scheme of LDPE and LLDPE foils production process is presented in Fig. 3. The facility is ISO 9001 and 14001 certified.

### **Modules C1-C4 and D: *End-of-life (EoL)***

The deconstruction of LDPE and LLDPE foils is assumed to be done with the demolition of the whole structure, so that impacts from the LDPE and LLDPE foils deconstruction are negligibly small. Therefore, no contribution in terms of impact of C1 module is reported. It is assumed that the end-of-life product, 100% of LDPE and LLDPE foils, will be transported to waste treatment plant which is 100 km away, on 16-32 t lorry EURO 5 (module C2). No reuse, energy/material recovery or recycling of the LDPE and LLDPE foils is intended. The benefits of using regranulates are included in module

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A1. In order to avoid double counting of these benefits, C3 module is not reported (equal to 0). After the end of use 100% of the product would end up in landfill. End-of-life scenario was summarized in Table 1. Benefits and potential credits are assessed when substitution of primary raw material takes place. As LDPE and LLDPE foils and their parts are not recyclable this modulus is not declared.

Table 1. End-of-life scenario for LDPE and LLDPE foils manufactured by WARTER POLYMERS Sp. z o. o.

| Material             | Waste processing<br>(energy / material recovery) | Landfilling |
|----------------------|--|-------------|
| LDPE and LLDPE foils | 0 %  | 100 %       |

### Data quality

The data selected for LCA analysis originate from ITB-LCI questionnaires completed by WARTER POLYMERS Sp. z o. o. using the inventory data, ITB database, Ecoinvent database v. 3.10 and KOBiZE. KOBiZE data is supplemented with Ecoinvent v. 3.10 data on the national electricity mix impact where no specific indicator data is provided. No specific data collected is older than five years and no generic datasets used are older than ten years. The representativeness, completeness, reliability, and consistency are judged as good.

### Data collection period

Primary data provided by WARTER POLYMERS Sp. z o. o. covers a period of 01.2022 – 12.2022 (1 year). The life cycle assessments were prepared for Poland and Europe as reference area.

### Assumptions and estimates

The impacts of the representative of LDPE and LLDPE foils were aggregated using average weights. Impacts were inventoried and obtained results are calculated as a representative average for all LDPE and LLDPE foils produced in different thicknesses. The density conversion factor for LDPE and LLDPE foils is 0.92 g/cm<sup>3</sup>.

### Calculation rules

LCA was performed using ITB-LCA tool developed in accordance with EN 15804 + A2.

### Databases

The data for the processes comes from Ecoinvent v. 3.10 and ITB-Database. Specific data quality analysis was a part of external audit. Polish electricity mix used (production) is 0.685 kg CO<sub>2</sub>/kWh (KOBiZE 2023).

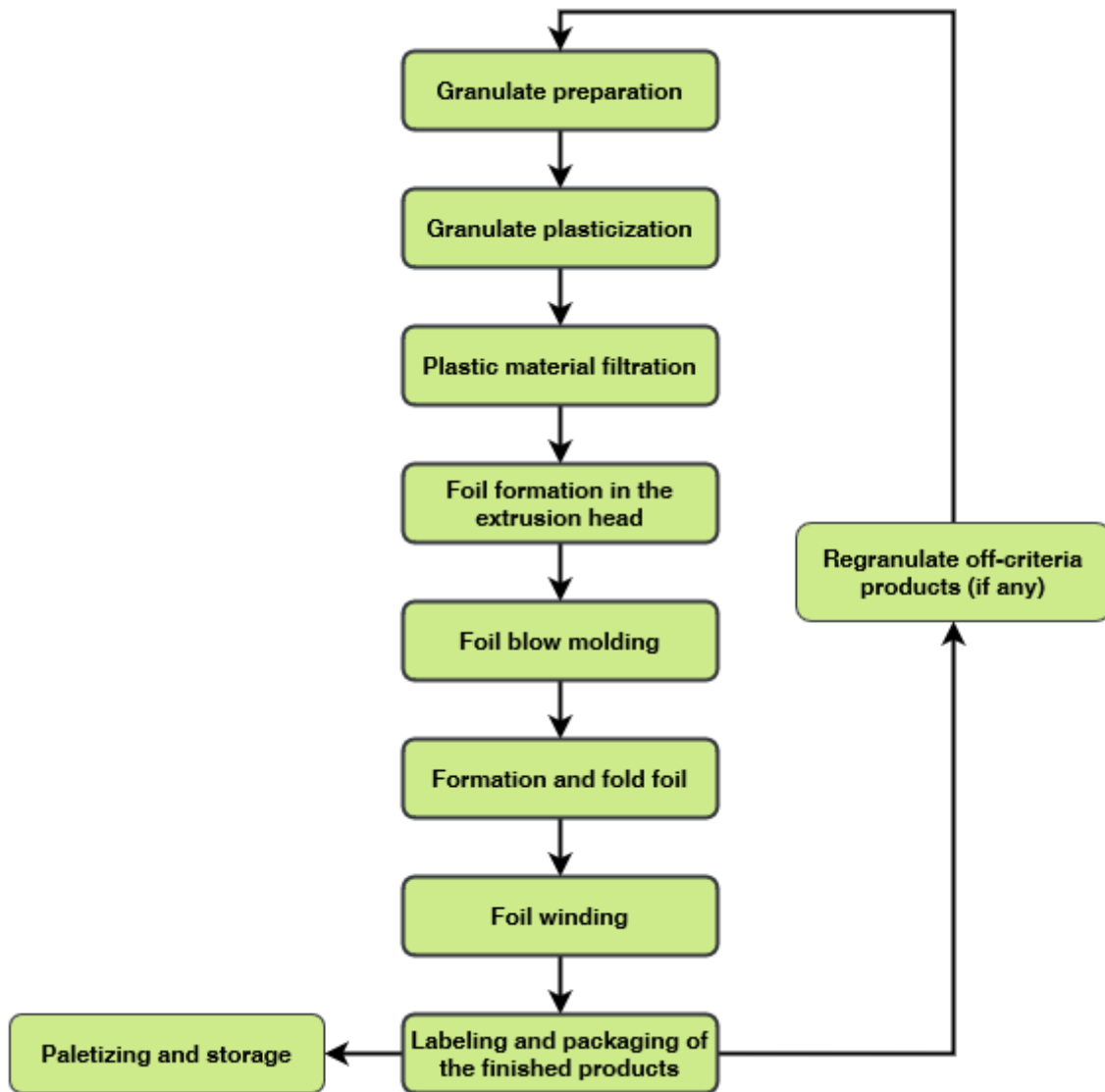


Fig. 3. The scheme of the LDPE and LLDPE foils industrial process by WARTER POLYMERS Sp. z o. o.

**LIFE CYCLE ASSESSMENT (LCA) – Results**

**Declared unit**

The declaration refers to declared unit (DU) – 1 kg of LDPE and LLDPE foils manufactured by WARTER POLYMERS Sp. z o. o.

*Table 2. System boundaries for the environmental characteristic of LDPE and LLDPE foils production process by WARTER POLYMERS Sp. z o. o.*

| <b>Environmental assessment information (MD – Module Declared, MND – Module Not Declared, INA – Indicator Not Assessed)</b> |           |               |                           |                                   |           |             |        |             |               |                        |                       |                           |           |                  |          |   |
|---|-----------|---------------|---------------------------|-----------------------------------|-----------|-------------|--------|-------------|---------------|------------------------|-----------------------|---------------------------|-----------|------------------|----------|---|
| Product stage   |           |               | Construction process      |                                   | Use stage |             |        |             |               |                        |                       | End of life               |           |                  |          | Benefits and loads beyond the system boundary |
| Raw material supply   | Transport | Manufacturing | Transport to construction | Construction-installation process | Use       | Maintenance | Repair | Replacement | Refurbishment | Operational energy use | Operational water use | Deconstruction 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   |
| MD  | MD        | MD            | MND                       | MND                               | MND       | MND         | MND    | MND         | MND           | MND                    | MND                   | MD                        | MD        | MD               | MD       | MD  |

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Table 3. Life cycle assessment (LCA) results of LDPE and LLDPE foils manufactured by WARTER POLYMERS Sp. z o. o. – environmental impacts (DU: 1 kg)

| Indicator   | Unit                   | A1       | A2       | A3       | A1-A3    | C1       | C2       | C3       | C4       | D        |
|---|------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| Global Warming Potential  | eq. kg CO <sub>2</sub> | 9.21E-01 | 8.33E-02 | 2.14E-01 | 1.22E+00 | 0.00E+00 | 1.80E-02 | 0.00E+00 | 1.29E-01 | 0.00E+00 |
| Greenhouse gas potential - fossil                                   | eq. kg CO <sub>2</sub> | 9.03E-01 | 8.30E-02 | 2.13E-01 | 1.20E+00 | 0.00E+00 | 1.80E-02 | 0.00E+00 | 1.29E-01 | 0.00E+00 |
| Greenhouse gas potential - biogenic                                 | eq. kg CO <sub>2</sub> | 1.38E-02 | 2.84E-04 | 1.35E-03 | 1.54E-02 | 0.00E+00 | 6.14E-05 | 0.00E+00 | 9.23E-05 | 0.00E+00 |
| Global warming potential - land use and land use change             | eq. kg CO <sub>2</sub> | 4.14E-03 | 3.26E-05 | 7.47E-05 | 4.25E-03 | 0.00E+00 | 7.05E-06 | 0.00E+00 | 6.93E-06 | 0.00E+00 |
| Stratospheric ozone depletion potential                             | eq. kg CFC 11          | 3.46E-08 | 1.92E-08 | 5.83E-09 | 5.97E-08 | 0.00E+00 | 4.15E-09 | 0.00E+00 | 3.12E-10 | 0.00E+00 |
| Soil and water acidification potential                              | eq. mol H+             | 3.39E-03 | 3.37E-04 | 2.27E-03 | 6.00E-03 | 0.00E+00 | 7.29E-05 | 0.00E+00 | 8.60E-05 | 0.00E+00 |
| Eutrophication potential - freshwater                               | eq. kg P               | 3.13E-04 | 5.58E-06 | 3.86E-04 | 7.04E-04 | 0.00E+00 | 1.21E-06 | 0.00E+00 | 1.29E-06 | 0.00E+00 |
| Eutrophication potential - seawater                                 | eq. kg N               | 7.24E-04 | 1.02E-04 | 3.24E-04 | 1.15E-03 | 0.00E+00 | 2.20E-05 | 0.00E+00 | 2.86E-04 | 0.00E+00 |
| Eutrophication potential - terrestrial                              | eq. mol N              | 6.49E-03 | 1.11E-03 | 2.78E-03 | 1.04E-02 | 0.00E+00 | 2.40E-04 | 0.00E+00 | 3.51E-04 | 0.00E+00 |
| Potential for photochemical ozone synthesis                         | eq. kg NMVOC           | 4.90E-03 | 3.40E-04 | 7.83E-04 | 6.03E-03 | 0.00E+00 | 7.35E-05 | 0.00E+00 | 1.52E-04 | 0.00E+00 |
| Potential for depletion of abiotic resources - non-fossil resources | eq. kg Sb              | 8.42E-06 | 2.94E-07 | 3.08E-07 | 9.02E-06 | 0.00E+00 | 6.36E-08 | 0.00E+00 | 2.72E-08 | 0.00E+00 |
| Abiotic depletion potential - fossil fuels                          | MJ                     | 2.59E+01 | 1.23E+00 | 3.60E+00 | 3.07E+01 | 0.00E+00 | 2.66E-01 | 0.00E+00 | 2.69E-01 | 0.00E+00 |
| Water deprivation potential   | eq. m <sup>3</sup>     | 3.81E-01 | 5.70E-03 | 7.06E-02 | 4.57E-01 | 0.00E+00 | 1.23E-03 | 0.00E+00 | 1.28E-03 | 0.00E+00 |



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Table 4. Life cycle assessment (LCA) results of LDPE and LLDPE foils manufactured by WARTER POLYMERS Sp. z o. o. – additional impacts indicators (DU: 1 kg)

| Indicator  | Unit              | A1  | A2  | A3  | A1-A3 | C1  | C2  | C3  | C4  | D   |
|--|-------------------|-----|-----|-----|-------|-----|-----|-----|-----|-----|
| Particulate matter   | disease incidence | INA | INA | INA | INA   | INA | INA | INA | INA | INA |
| Potential human exposure efficiency relative to U235             | eg. kBq U235      | INA | INA | INA | INA   | INA | INA | INA | INA | INA |
| Potential comparative toxic unit for ecosystems                  | CTUe              | INA | INA | INA | INA   | INA | INA | INA | INA | INA |
| Potential comparative toxic unit for humans (cancer effects)     | CTUh              | INA | INA | INA | INA   | INA | INA | INA | INA | INA |
| Potential comparative toxic unit for humans (non-cancer effects) | CTUh              | INA | INA | INA | INA   | INA | INA | INA | INA | INA |
| Potential soil quality index                                     | dimensionless     | INA | INA | INA | INA   | INA | INA | INA | INA | INA |

Table 5. Life cycle assessment (LCA) results of LDPE and LLDPE foils manufactured by WARTER POLYMERS Sp. z o. o. - environmental information describing waste categories (DU: 1 kg)

| Indicator  | Unit           | A1        | A2       | A3       | A1-A3     | C1       | C2       | C3       | C4        | D        |
|--|----------------|-----------|----------|----------|-----------|----------|----------|----------|-----------|----------|
| Consumption of renewable primary energy - excluding renewable primary energy sources used as raw materials     | MJ             | 1.86E+00  | 1.77E-02 | 2.52E-01 | 2.13E+00  | 0.00E+00 | 3.82E-03 | 0.00E+00 | 4.03E-03  | 0.00E+00 |
| Consumption of renewable primary energy resources used as raw materials  | MJ             | 3.43E-01  | 0.00E+00 | 0.00E+00 | 3.43E-01  | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00  | 0.00E+00 |
| Total consumption of renewable primary energy resources  | MJ             | 2.20E+00  | 1.77E-02 | 2.52E-01 | 2.47E+00  | 0.00E+00 | 3.82E-03 | 0.00E+00 | 4.03E-03  | 0.00E+00 |
| Consumption of non-renewable primary energy - excluding renewable primary energy sources used as raw materials | MJ             | -1.85E+01 | 1.23E+00 | 3.72E+00 | -1.35E+01 | 0.00E+00 | 2.66E-01 | 0.00E+00 | -4.20E+01 | 0.00E+00 |
| Consumption of non-renewable primary energy resources used as raw materials                                    | MJ             | 4.44E+01  | 0.00E+00 | 2.74E-02 | 4.44E+01  | 0.00E+00 | 0.00E+00 | 0.00E+00 | 4.23E+01  | 0.00E+00 |
| Total consumption of non-renewable primary energy resources  | MJ             | 2.59E+01  | 1.23E+00 | 3.81E+00 | 3.10E+01  | 0.00E+00 | 2.66E-01 | 0.00E+00 | 2.69E-01  | 0.00E+00 |
| Consumption of secondary materials   | kg             | 8.17E-01  | 4.13E-04 | 2.86E-04 | 8.18E-01  | 0.00E+00 | 8.93E-05 | 0.00E+00 | 9.71E-05  | 0.00E+00 |
| Consumption of renewable secondary fuels   | MJ             | 4.50E-03  | 4.55E-06 | 1.57E-06 | 4.51E-03  | 0.00E+00 | 9.84E-07 | 0.00E+00 | 1.82E-06  | 0.00E+00 |
| Consumption of non-renewable secondary fuels   | MJ             | 0.00E+00  | 0.00E+00 | 0.00E+00 | 0.00E+00  | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00  | 0.00E+00 |
| Net consumption of freshwater resources  | m <sup>3</sup> | 1.02E-02  | 1.55E-04 | 1.17E-03 | 1.16E-02  | 0.00E+00 | 3.35E-05 | 0.00E+00 | -3.99E-03 | 0.00E+00 |

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Table 6. Life cycle assessment (LCA) results of LDPE and LLDPE foils manufactured by WARTER POLYMERS Sp. z o. o. - environmental aspects related to resource use (DU: 1 kg)

| Indicator                       | Unit | A1       | A2       | A3       | A1-A3    | C1       | C2       | C3       | C4       | D        |
|---------------------------------|------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| Hazardous waste. neutralized    | kg   | 9.26E-02 | 1.38E-03 | 2.33E-05 | 9.40E-02 | 0.00E+00 | 2.99E-04 | 0.00E+00 | 4.75E-04 | 0.00E+00 |
| Non-hazardous waste neutralised | kg   | 1.08E+01 | 2.45E-02 | 2.25E-02 | 1.09E+01 | 0.00E+00 | 5.31E-03 | 0.00E+00 | 5.37E+00 | 0.00E+00 |
| Radioactive waste               | kg   | 4.39E-05 | 8.49E-06 | 3.73E-06 | 5.61E-05 | 0.00E+00 | 1.84E-06 | 0.00E+00 | 6.64E-08 | 0.00E+00 |
| Components for re-use           | kg   | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Materials for recycling         | kg   | 9.11E-04 | 3.81E-06 | 4.86E-04 | 1.40E-03 | 0.00E+00 | 8.25E-07 | 0.00E+00 | 4.55E-06 | 0.00E+00 |
| Materials for energy recovery   | kg   | 1.31E-06 | 3.08E-08 | 3.12E-08 | 1.37E-06 | 0.00E+00 | 6.67E-09 | 0.00E+00 | 1.86E-08 | 0.00E+00 |
| Energy exported                 | MJ   | 4.37E-02 | 1.37E-03 | 1.01E-02 | 5.52E-02 | 0.00E+00 | 2.96E-04 | 0.00E+00 | 5.66E-05 | 0.00E+00 |

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### Verification

The process of verification of this EPD is in accordance with ISO 14025 and ISO 21930. After verification, this EPD is valid for a 5-year-period. EPD does not have to be recalculated after 5 years, if the underlying data have not changed significantly.

|  |                                   |
|--|-----------------------------------|
| The basis for LCA analysis was EN 15804+A2 and ITB PCR A               |                                   |
| Independent verification corresponding to ISO 14025 (subclause 8.1.3.) |                                   |
| <input checked="" type="checkbox"/> external                           | <input type="checkbox"/> internal |
| External verification of EPD: Halina Prejzner, PhD Eng                 |                                   |
| LCA, LCI audit and input data verification: Mateusz Kozicki, PhD       |                                   |
| Verification of LCA: Michał Piasecki, PhD. DSc. Eng                    |                                   |

Note 1: The declaration owner has the sole ownership, liability and responsibility for the information provided and contained in EPD. Declarations within the same product category but from different programmes may not be comparable. Declarations of construction products may not be comparable if they do not comply with EN 15804 + A2. For further information about comparability, see EN 15804 + A2 and ISO 14025. Depending on the application, a corresponding conversion factor such as the specific weight per surface area must be taken into consideration.

Note 2: ITB is a public Research Organization and Notified Body (EC Reg. no 1488) to the European Commission and to other Member States of the European Union designated for the tasks concerning the assessment of building products' performance. ITB acts as the independent, third-party verification organization (17065/17025 certified). ITB-EPD program is recognized and registered member of The European Platform – Association of EPD program operators and ITB-EPD declarations are registered and stored in the international ECO-PORTAL.

### Normative references

- ITB PCR A v. 1.6 General Product Category Rules for Construction Products
- EN 13967:2012 Flexible sheets for waterproofing - Plastic and rubber damp proof sheets including plastic and rubber basement tanking sheet - Definitions and characteristics
- EN 13984:2013 Flexible sheets for waterproofing - Plastic and rubber vapour control layers - Definitions and characteristics
- EN 14909:2012 Flexible sheets for waterproofing - Plastic and rubber damp proof courses - Definitions and characteristics
- ISO 14025:2006 Environmental labels and declarations – Type III environmental declarations – Principles and procedures
- ISO 21930:2017 Sustainability in buildings and civil engineering works – Core rules for environmental product declarations of construction products and services
- ISO 14044:2006 Environmental management – Life cycle assessment – Requirements and guidelines
- ISO 15686-1:2011 Buildings and constructed assets – Service life planning – Part 1: General principles and framework
- ISO 15686-8:2008 Buildings and constructed assets – Service life planning – Part 8: Reference service life and service-life estimation
- ISO 20915:2018 Life cycle inventory calculation methodology for steel products
- EN 15804:2012+A2:2019 Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products

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- ISO 14067:2018 Greenhouse gases - Carbon footprint of products — Requirements and guidelines for quantification
- EN 15942:2012 Sustainability of construction works – Environmental product declarations – Communication format business-to-business
- KOBiZE Emissions (CO<sub>2</sub>, SO<sub>2</sub>, NO<sub>x</sub>, CO and total dust) from electricity, 2023

LCA, LCI audit and input data verification  
Mateusz Kozicki, PhD

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Head of the Thermal Physic, Acoustics  
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Agnieszka Winkler-Skalna, PhD

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# **CERTIFICATE No 659/2024 of TYPE III ENVIRONMENTAL DECLARATION**

Products:

**LDPE and LLDPE foils**

Manufacturer:

**Warter Polymers Sp. z o.o.**

Witolda Zglenickiego 5, 09-411 Płock, Poland

confirms the correctness of the data included in the development of  
Type III Environmental Declaration and accordance with the requirements of the standard

**EN 15804+A2**

**Sustainability of construction works.**

**Environmental product declarations.**

**Core rules for the product category of construction products.**

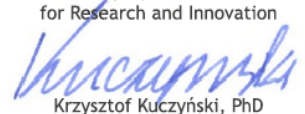
This certificate, issued on 11<sup>th</sup> September 2024 is valid for 5 years  
or until amendment of mentioned Environmental Declaration

Head of the Thermal Physic, Acoustics  
and Environment Department

  
Agnieszka Winkler-Skalna, PhD



Deputy Director  
for Research and Innovation

  
Krzysztof Kuczyński, PhD

Warsaw, September 2024