ENVIRONMENTAL PRODUCT DECLARATION

as per *ISO 14025* and *EN 15804+A2*

Owner of the Declaration	Adolf Würth GmbH & Co. KG
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-AWU-20230269-IBD1-EN
Issue date	12.09.2023
Valid to	12.09.2027

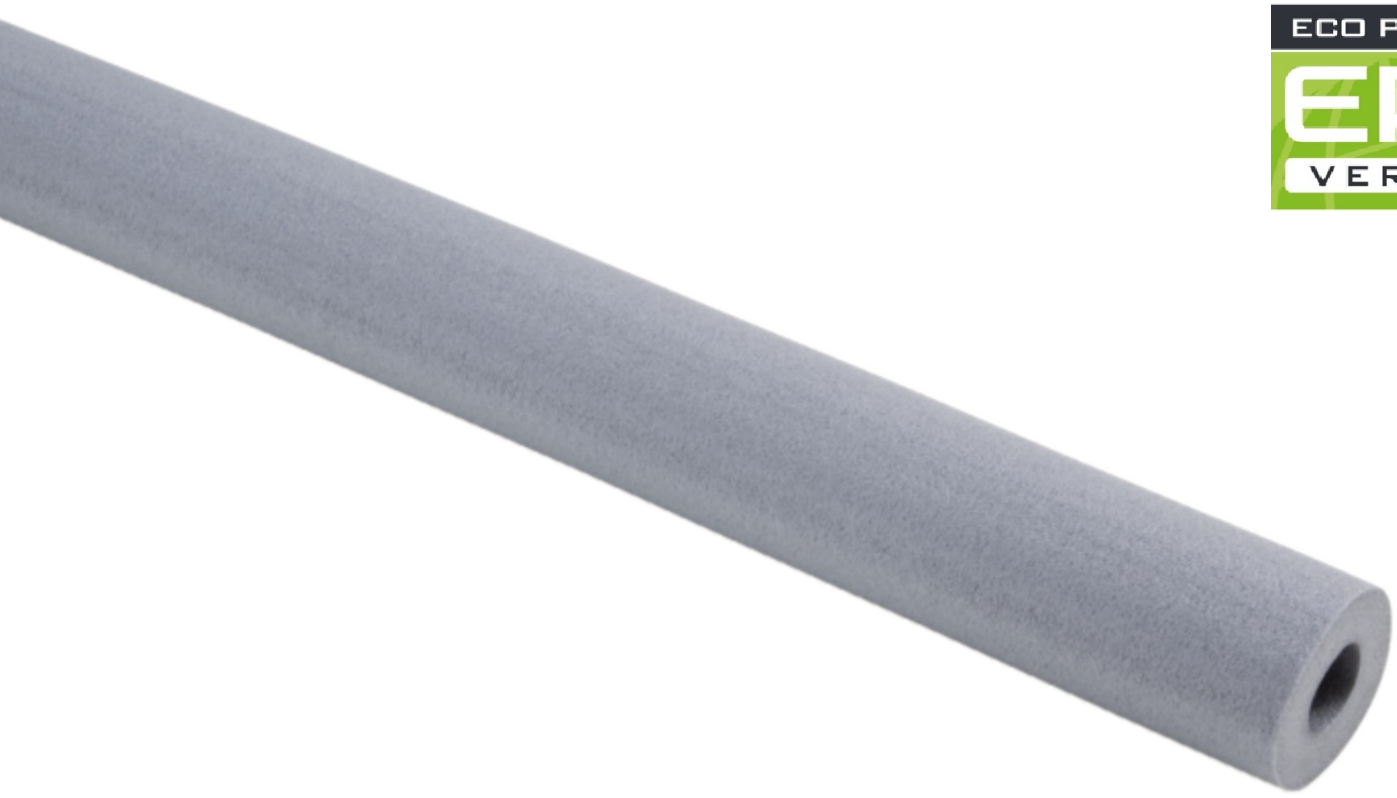
flexen®PE

Adolf Würth GmbH & Co. KG

Institut Bauen und Umwelt e.V.

ECO PLATFORM EPD VERIFIED

www.ibu-epd.com | https://epd-online.com



1. General Information

Adolf Würth GmbH & Co. KG

Programme holder

IBU – Institut Bauen und Umwelt e.V.
Hegelplatz 1
10117 Berlin
Germany

Declaration number

EPD-AWU-20230269-IBD1-EN

This declaration is based on the product category rules:

Insulating materials made of foam plastics, 01.08.2021
(PCR checked and approved by the SVR)

Issue date

12.09.2023

Valid to

12.09.2027

Dipl.-Ing. Hans Peters
(Chairman of Institut Bauen und Umwelt e.V.)

Florian Pronold
(Managing Director Institut Bauen und Umwelt e.V.)

flexen®PE

Owner of the declaration

Adolf Würth GmbH & Co. KG
Reinhold-Würth-Str. 12-17
74653 Künzelsau
Germany

Declared product / declared unit

flexen® PE

Scope:

Product line flexen® PE Thermal insulation products for building equipment and industrial insulations made of polythene [BSJ1] foam (PEF) according to EN14313, describing the specific environmental performance of the product produced in Belgium at the site of Eynatten 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.

The EPD was created according to the specifications of EN 15804+A2. In the following, the standard will be simplified as *EN 15804*.

Verification

The standard EN 15804 serves as the core PCR
Independent verification of the declaration and data according to ISO 14025:2011
☐ internally ☒ externally

Vito D'Incognito,
(Independent verifier)

2. Product

2.1 Product description/Product definition

flexen® PE Polyethylene foams have many environmental benefits, having a low density (average 24.3 kg/m³), few raw materials are required for the manufacture of an article and the environmental
impact of their transport is lower than similar articles of higher density performing the same function. Furthermore, the flexen® PE are fully recyclable.
For the placing on the market of the product in the European Union/European Free Trade Association (EU/EFTA)(with the exception of Switzerland) - Thermal Insulation products for building equipment and industrial installations cf. PCR. Factory made polyethylene foam (PEF) and the CE-marking. For the application
and use the respective national provisions apply

2.2 Application

The function of flexen® PE 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 pipes are still effective after 50 years, it is assumed that when replacing the piping, the insulation flexen® PE is not reused and
is recycled. 50 years is the minimum Reference Service Life recommended in *EN 16783*

2.3 Technical Data

The technical specifications of the products within the scope of the EPD shall be listed, including the reference to the test methods/test standards for each specification.

For products with CE marking, the technical specifications must be specified in accordance with information in the declaration of performance. The properties relevant to the product should be specified in the table below. If no information is given for properties, an explanation must be given in the background report to the EPD as to why the property is not relevant to the product.

Constructional data

Performance data of the product in accordance with the Declaration of Performance with respect to its Essential Characteristics according to *EN 14313* apply. Further data:

Name	Value	Unit
Gross density	24.3	kg/m^3
Thermal conductivity	0.036 - 0.048	W/(mK)
Reaction To Fire Acc. to EN 13501-1 depending on the thickness	Bl-s1d0 ; Cl-s1d0	-
Max Service Temperature Acc. To 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	Cl < 10 – F < 4 - pH 6,8	-

2.4 Delivery status

The flexen® PE product is a closed-cell polyethylene foam, containing recycled PE, insulation tube designed for applications in heating and sanitary installations. The flexen® PE range extends from 5 to 25 mm thick and from 12 to 114mm inside diameter. They
are delivered in lengths of 2 m packed in cardboard. (More information on ranges and dimensions on WÜRTH (wuerth.de).)

2.5 Base materials/Ancillary materials

Base materials

flexen® PE are flexible insulation materials containing recycled PE, which is produced
using a mixture of up to seven basic component materials. The following table displays an average weighted of different elements of the formulation, and this for the complete flexen® PE product range. The following table displays the different elements of the formulation for flexen® PE. This is in accordance with the PCR Part B: Requirements on the EPD for Insulating materials made of foam plastics and ISO14025. This product contains substances listed in the candidate list (date: 08.07.2021) exceeding 0.1
percentage by mass: **No.**
This product contains other carcinogenic, mutagenic, reprotoxic (CMR) substances in categories 1A or 1B, which are not on the candidate list, exceeding 0.1 percentage by mass: **No.**
Biocide products were added to this construction product or it has been treated with biocide products (this then concerns a treated product as defined by the (EU) *Ordinance on Biocide Products 528/2012) :* ***No***

Name	Value	Unit
LDPE	36.50	%
Flame Retardant	5.70	%
LLDPE	18.51	%
Internally recycled PE	25.10	%
Pigment	3.76	%
Volume stabilizer	2.00	%
Blowing Agent	8.43	%

Low Density Polyethylen (LDPE), internally recycled PE and fillers are the main components of the product and are responsible for the characteristics and
performance of the product The blowing agent causes the expansion during manufacturing. The flame retardant ensures the fire resistance and conformity with fire protection regulations (see section 2.13). According the European Chemicals Regulation *REACH* manufacturers, importers and downstream users must register their chemicals and are responsible for their safe use. Adolf Würth GmbH & Co. KG uses exclusively verifiably registered and approved substances in its production. flexen® PE do not contain Substances of Very High Concern (SVHC). Antimony trioxide and halogenated flame retardants are used.

2.6 Manufacture

The manufacturing process consists of a continuous extrusion. Solid pellets of thermoplastic resin are fed into 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 it 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 (i.e. atmospheric pressure). The blowing agent expands to form the cells of the foam and the thermoplastic foam is cooled through an inline water cooler. At the end of the inline cooler the profiles are cut to the required dimensions.

Quality assurance :
The manufacture is certified ISO 9001 for quality management. The product corresponds to the product standard EN 14313 and has a Declaration of
Performance according to the DOP no.
LE_0870609015_01_M_flexen_PE
(see www.wuerth.de)

2.7 Environment and health during manufacturing

During all manufacturing steps the production follows all national guidelines and regulations. Solar panels are installed on the roof of
the warehouse and in the field to reduce the requirement for grid electricity.

2.8 Product processing/Installation

flexen® PE can be installed using basic tools (e.g. craft knives). No special tools, nor specific protection is necessary. When applying adhesives the information given in the relevant safety data sheets is
to be heeded. Any glue and adhesive tapes used during the installation phase were not included in the LCA. Recommendations on how to use the product are described in the application manuals or videos. More details are listed on the Web Page WÜRTH (wuerth.de).

2.9 Packaging

flexen® PE products are packed in cardboard boxes and transported on reusable pallets. All packaging material can be recycled. The pallets used to transport the products are taken back or exchanged when the flexen® PE is delivered, so the use of pallets is a closed loop economy.

2.10 Condition of use

During the use of the products for the purpose for
which they are intended, there are no modifications
unless one of the effects listed in extraordinary impacts occurs (see point 2.13).

2.11 Environment and health during use

There are no particular effects on environmental and health impacts during use related to the material composition of the product. The
flexen® PE products are used in a wide range of applications across the building sector. The PEF foams fulfil the German, Belgian and French regulations regarding the emission of VOC with emissions far below the most stringent limit values. The Eurofin Product Testing institute, at the request 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 flexen® PE allows a reduction of energy dispersion and of course CO_2 emissions during the full service life of the installation. The quantification of this in-use benefit is not within the scope of this EPD, however, this could be calculated using an LCA for the complete pipe/insulation system, and has to be evaluated in the frame of the LCA from the complete heating installation.

2.12 Reference service life

The function of flexen® PE is to ensure 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 pipes are still effective after 50 years, it is assumed that when replacing the piping, the insulation (flexen® PE) is recycled. 50 years is the minimum Reference Service Life recommended in *EN16783* "PCR for factory made thermal insulation products". Description of the influences on the ageing of the product when applied in accordance with the rules of technology.

2.13 Extraordinary effects

Fire

flexen® PE is classified as a combustible insulation material. Due to its material structure, flexen® PE does not contribute to an uncontrollable spread of fire under installation conditions typical on a building site. The product is self-extinguishing reducing its contribution to any fire event. There is no possibility of the material
self-igniting. flexen® PE does not propagate the fire horizontally or vertically. The smoke development in case of fire is very low (class S1).

Fire protection

Name	Value
Building material class	Bl/Cl
Burning droplets	d0
Smoke gas development	s1

Water

flexen® PE is a closed cell foam and obtains the best water absorption class WS005 according to the product standard.

Mechanical destruction

flexen® PE is chemically inert and does not present any environmental or health risk if mechanically destructed. flexen® PE is not UV resistant. The product is not recommended for outside applications without complementary UV protection

2.14 Re-use phase

In principle, if removed carefully, flexen® PE can be reused on any other piping system of similar dimensions. Any material not suitable for reuse is fully recyclable.

2.15 Disposal

The flexen® PE is fully recyclable and can be used as a direct one-for-one substitute for virgin PE-LD granulates, with only minor additive additions. There is no chemical difference between recycled PE and fossil fuel derived PE-LD, so using a mix of sources does not change the recyclability of the product.

2.16 Further information

Additional information about flexen® PE can be found on the web site www.wuerth.de Here specification clauses, data sheets and application manuals can be found.

3. LCA: Calculation rules

3.1 Declared Unit

The declared unit for insulating materials made of foam plastic is 1 m³. The EPD will cover the whole flexen® PE range. The insulating
sleeves in the flexen® PE range have a thickness ranging from 5 to 25mm and an inside diameter ranging from 12 to 114mm The average reference density of flexen® PE is 24.3 kg/m³.

Declared unit

Name	Value	Unit
Gross density	24.3	kg/m^3
Declared unit	1	m^3
Declared unit	-	λ
Conversion factor from 1 m³ to 1 linear meter	Value for 1 m divided section of the insulation pipe (m²)	m
Gross Density volume for 1 kg	0.0412	m³
Thermal Conductivity at 40°C	0.040	W/(mK)

Thermal Conductivity λ : 0.040 W/mK at (40°C)
R-value- thickness- : 25 mm : +/- 3.5 (m²K/W)
depending on the pipe diameter.

3.2 System boundary

The Data collection refers to the yearly production in 2021.
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:
The logistics department reported average figures for the distribution of products - depending on the country the transport distance varies. The biggest customers represent 85% of sales volumes in 2021, with the remainder supplied to
a large set of smaller customers.
Module A5:
Installation of flexen® PE 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. Some glue or tape could be used for the installation, as the quantity of the product used depends on the final customer, he has to calculate the impact of what he used himself. The environmental
impact of this type of accessory is not counted in this study. The calculations do not contain any installation waste. Cardboard as a packaging material is assumed to be recycled. As input material cardboard made of waste paper is considered. Thus, the environmental burden of packaging materials are considered already in A1-A3. The value of the environmental impact for A5
is declared as '0'. The choice made is : the final user has to calculate the impact of A5 himself in the function of his own case, by accounting for the extra amount of product needed during installation.
Module B1-B7:
Once installed the flexen® PE product requires no maintenance and no repair. It will be dismantled when the sanitary pipe is replaced. For this reason, there are not expected to be any impacts in B1 to B7 assuming correct specification and installation. Step B1 is not considered in this LCA, although the insulation of the piping contributes to a significant reduction of CO_2 emissions from the heating or cooling equipment, this is not taken into account in this LCA. It should,
however, be taken into account in the calculation of the environmental impacts of the complete heating and cooling systems or of the complete building.
Module C1:
As for the installation of the product, the disassembly is done manually and does not require any specific equipment. Disassembly is generally carried out at the same time as the replacement or removal of sanitary pipes. Consequently, there are no impacts associated with C1.
Module C2:
Transport at the end-of-life stage is modelled as a Euro Cargo 0-6 mix truck with diesel fuel. The average distance to either mechanical recycling, incineration or landfills is assumed to be 100 km.
Module C3:
The scenario that has been retained for
this Life Cycle Assessment is the 100% recycling scenario.
Module C4:
As flexen® PE is fully
recyclable, the legislation is pushing more in this direction and the overall pressure on plastic recycling is growing, the scenario with recycling is considered.
Module D:
The flexen® PE is fully
recyclable and can be used as a direct one-for-one substitute for virgin PE-LD granulates, with only minor additive additions.

3.3 Estimates and assumptions

The LCA calculation is conducted using the *Gabi ts* - database. Not all necessary LCIs are included in the database. Where data were missing or were unavailable or where suppliers were unable to provide complete information, proxy datasets have been used.
The environmental burden for the production of pigments, flame retardants and volume stabilizers are approximated.

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 10 developed by thinkstep AG* was used to perform this LCA. *The GaBi LCI database GaBi 10* 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 2021.

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 included in the *GaBi 10 software*. For electrical and thermal energy Belgium-specific grid mixes and Belgium-specific supply for natural gas were considered.

3.7 Period under review

The production data for the year 2021 were used for the realization of this study

3.8 Geographic Representativeness

Land or region, in which the declared product system is manufactured, used or handled at the end of the product´s lifespan: Germany

3.9 Allocation

There is no co-product or by-product generated during the production of Adolf Würth GmbH & Co. KG products. Due to the lack of specific data per production line and product, the energy has been allocated per overall produced volume of insulation foam.

Production waste

Most of the 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

Installation of the foam products is done by hand and requires no special equipment apart from a knife. Installation off-cut is not considered in this calculations. Any glue and adhesive tapes used during the installation phase were not included in the LCA

3.10 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

Characteristic product properties of biogenic carbon

The biogenic carbon content quantifies the amount of biogenic carbon in a construction product leaving the factory gate, and it shall be separately declared for the product and for any accompanying packaging.
If the total mass of biogenic carbon containing materials is less than 5 % of the total mass of the product and accompanying packaging, the declaration of biogenic carbon content may be omitted. The mass of packaging containing biogenic carbon shall always be declared.

Note: 1 kg of biogenic carbon is equivalent to 44/12 kg of CO2.

Information on describing the biogenic Carbon Content at factory gate

Name	Value	Unit
Biogenic carbon content in product	-	kg C
Biogenic carbon content in accompanying packaging	3.62	kg C

The following technical scenario information is required for the declared modules and optional for non-declared modules. Modules for which no information is declared can be deleted; additional information can also be listed if necessary.

The following technical information is a basis for the declared modules or can be used for developing specific scenarios in the context of a building assessment if modules are not declared (MND).

A5 is not declared including the disposal of the packaging material on the construction site, the amounts of packaging materials included in the LCA calculations must be declared as technical scenario information for Module A5.

Transport to the building site (A4)

Name	Value	Unit
Litres of fuel	0.045	l/100km
Transport distance	488	km
Capacity utilisation (including empty runs)	10	%
Gross density of products transported	24.3	kg/m^3

In case a **reference service life** according to applicable ISO standards is declared then the assumptions and in-use conditions underlying the determined RSL shall be declared. In addition, it shall be stated that the RSL applies to the reference conditions only.

The same holds for a service life declared by the manufacturer. Corresponding information related to in-use conditions needs not be provided if a service life taken from the list of service life by *BNB* is declared.

Reference service life

Name	Value	Unit
Reference service life	50	a

End of life (C1-C4)

Name	Value	Unit
Recycling	24.3	kg

5. LCA: Results

In Table 1 "Description of the system boundary", all declared modules shall be indicated with an "X"; all modules that are not declared shall be indicated with "MND" (As default the modules B3, B4, B5 are marked as MNR – module not relevant). In the following tables, columns can be deleted for modules that are not declared. Indicator values should be declared with three valid digits (eventually using the exponential form (e.g. 1,23E-5 = 0,0000123). A uniform format should be used for all values of one indicator.
If several modules are not declared and therefore have been deleted from the table, the abbreviations for the indicators can be replaced by the complete names, while the readability and clear arrangement should be maintained; the legends can then be deleted.
If due to relevant data gaps, an indicator cannot be declared in a robust way, then the abbreviation “IND” (indicator not declared) should be used for this indicator.

- 0 - calculated value is 0
- 0 - value falls under the cut-off
- 0 - assumption which exclude any flows (e.g. exported electricity A1-A3)
- IND – in cases where the inventory does not support the methodological approach or the calculation of the specific indicator IND shall be used.

If no reference service life is declared (see chapter 2.13 "Reference Service Life"), the LCA results of the modules B1-B2 and B6-B7 shall refer to a period of one year. This shall then be indicated as an explanatory text below the tables. In addition, the formula for the quantification of such B-modules over the total life cycle shall be provided.

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; ND = MODULE OR INDICATOR NOT DECLARED; MNR = MODULE NOT RELEVANT)

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	MNR	MNR	MNR	MND	MND	MND	X	X	X	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT according to EN 15804+A2: 1 m³ flexen®PE

Parameter	Unit	A1-A3	A4	A5	C2	C3	C4	D
GWP-total	kg CO_2 eq	6.51E+01	1.59E+00	0	1.47E-01	1.9E+00	0	-4.39E+01
GWP-fossil	kg CO_2 eq	6.52E+01	1.59E+00	0	1.48E-01	1.88E+00	0	-4.35E+01
GWP-biogenic	kg CO_2 eq	-1.93E-01	-2.01E-02	0	-1.45E-03	2.62E-02	0	-3.71E-01
GWP-luluc	kg CO_2 eq	7.38E-02	1.42E-02	0	9.97E-04	7.27E-04	0	-6.03E-03
ODP	kg CFC11 eq	1.69E-08	2E-13	0	1.45E-14	7.76E-11	0	-2.66E-10
AP	mol H^+ eq	2.41E-01	1.87E-03	0	1.75E-04	2.69E-03	0	-6.04E-02
EP-freshwater	kg P eq	2.64E-04	5.61E-06	0	5.29E-07	1.26E-05	0	-8.15E-05
EP-marine	kg N eq	3.51E-02	6.36E-04	0	5.84E-05	1.07E-03	0	-1.77E-02
EP-terrestrial	mol N eq	3.79E-01	7.51E-03	0	6.94E-04	1.09E-02	0	-1.84E-01
POCP	kg NMVOC eq	1.5E-01	1.91E-03	0	1.77E-04	2.6E-03	0	-5.77E-02
ADPE	kg Sb eq	1.81E-01	1.01E-07	0	1.49E-08	1.09E-06	0	-1.11E-05
ADPF	MJ	2E+03	2.09E+01	0	1.94E+00	5.63E+01	0	-1.68E+03
WDP	m^3 world eq deprived	5.2E+00	1.85E-02	0	1.66E-03	1.36E-01	0	-7.42E-01

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; WDP = Water (user) deprivation potential)

RESULTS OF THE LCA - INDICATORS TO DESCRIBE RESOURCE USE according to EN 15804+A2: 1 m³ flexen®PE

Parameter	Unit	A1-A3	A4	A5	C2	C3	C4	D
PERE	MJ	2.73E+02	1.52E+00	0	1.35E-01	3.47E+01	0	-1.26E+02
PERM	MJ	0	ND	ND	ND	ND	ND	ND
PERT	MJ	2.73E+02	1.52E+00	0	1.35E-01	3.47E+01	0	-1.26E+02
PENRE	MJ	1.13E+03	2.1E+01	0	1.95E+00	5.63E+01	0	-1.68E+03
PENRM	MJ	8.83E+02	ND	ND	ND	ND	ND	ND
PENRT	MJ	2.01E+03	2.1E+01	0	1.95E+00	5.63E+01	0	-1.68E+03
SM	kg	9.01E+00	ND	ND	ND	ND	ND	ND
RSF	MJ	0	ND	ND	ND	ND	ND	ND

NRSF	MJ	0	ND	ND	ND	ND	ND	ND
FW	m^3	3.47E-01	1.67E-03	0	1.56E-04	1.59E-02	0	-1.98E-01

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 – WASTE CATEGORIES AND OUTPUT FLOWS according to EN 15804+A2:
1 m³ flexen®PE

Parameter	Unit	A1-A3	A4	A5	C2	C3	C4	D
HWD	kg	1.8E-04	6.5E-11	0	1.03E-11	5.96E-09	0	-1.57E-07
NHWD	kg	2.69E+00	3.2E-03	0	3.18E-04	7.46E-02	0	-4.63E-01
RWD	kg	7.23E-02	3.93E-05	0	3.62E-06	1.31E-02	0	-1.4E-02
CRU	kg	ND	ND	ND	ND	ND	ND	ND
MFR	kg	ND	ND	9.01E+00	ND	2.43E+01	ND	ND
MER	kg	ND	ND	ND	ND	ND	ND	ND
EEE	MJ	ND	ND	ND	ND	ND	ND	ND
EET	MJ	ND	ND	ND	ND	ND	ND	ND

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; EET = Exported thermal energy

RESULTS OF THE LCA – additional impact categories according to EN 15804+A2-optional:
1 m³ flexen®PE

Parameter	Unit	A1-A3	A4	A5	C2	C3	C4	D
PM	Disease incidence	1.12E-05	1.41E-08	0	1.34E-09	2.14E-08	0	-4.54E-07
IR	kBq U235 eq	6.37E+00	5.86E-03	0	5.47E-04	9.12E-01	0	-1.39E+00
ETP-fw	CTUe	1.18E+03	1.49E+01	0	1.38E+00	2.19E+01	0	-7.98E+02
HTP-c	CTUh	3E-08	3.04E-10	0	2.84E-11	5.4E-10	0	-1.96E-08
HTP-nc	CTUh	2.41E-06	1.63E-08	0	1.56E-09	1.67E-08	0	-9.14E-07
SQP	SQP	1.76E+02	8.74E+00	0	8.22E-01	3.54E+01	0	-8.56E+01

PM = Potential incidence of disease due to PM emissions; IR = Potential Human exposure efficiency relative to U235; ETP-fw = Potential comparative Toxic Unit for ecosystems; HTP-c = Potential comparative Toxic Unit for humans (cancerogenic); HTP-nc = Potential comparative Toxic Unit for humans (not cancerogenic); SQP = Potential soil quality index

Disclaimer 1 – for the indicator “Potential Human exposure efficiency relative to U235”.This impact category deals mainly with the eventual impact of low dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure or radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, radon and from some construction materials is also not measured by this indicator.

Disclaimer 2 – for the indicators “abiotic depletion potential for non-fossil resources”, “abiotic depletion potential for fossil resources”, “water (user) deprivation potential, deprivation-weighted water consumption”, “potential comparative toxic unit for ecosystems”, “potential comparative toxic unit for humans – cancerogenic”, “Potential comparative toxic unit for humans - not cancerogenic”, “potential soil quality index”. The results of this environmental impact indicator shall be used with care as theuncertainties on these results are high as there is limited experience with the indicator. This EPD was created using a software tool.

6. LCA: Interpretation

The use of internal recycled material in flexen® PE reduces the need for raw materials and avoids wasting resources. flexen® PE has a very low density, which means that little raw material is needed for high insulation efficiency, which results in significant energy savings. In addition, flexen® PE is largely made of low-density polyethylene, so it is fully recyclable and can be recycled when it reaches the end of its life. As there is a variation in density between the different references of the flexen® PE range, a sensitivity analysis has been performed. The results of the LCA are given for 1m^3 of product calculated with an average weighted foam density of 24,3 kg/m³. For the lowest density, the impacts are lowered by 9,6 % and for the highest density the impacts should be majored by 27,3 %. Most references are very close to the average density, but all impact factors can be recalculated based on their density. When we analyse the complete life cycle, we see that the most impacting part for all environmental impact factors is the production module and more particularly the raw materials part. Regarding global warming for the complete life cycle, more than 95% comes from the production module 1,4% form transport to the places of installation and 3,0% comes from the end of life. A more in-depth analysis of the production module A1 to A3 shows that the production of raw materials and their transport account for almost 96% of the impact Global Warming Potential. As the flexen® PE is fully recyclable; the choice for the end of life was that of 100% recycling. This avoids the use of new raw materials and or the exploitation of renewable or non-renewable resources. The end of life in 100% landfill has a slight impact, especially from the point of view of climate change. However, the 100% incineration scenario has the greatest impact because during incineration there is a significant release of carbon dioxide. The insulation with flexen® PE of the sanitary and heating piping contributes to a significant reduction of CO_2 emissions from the heating or cooling equipment, this is not considered in this LCA. It should, however, be taken into account in the calculation of environmental impacts of the complete heating and cooling systems or of the complete building. One way to continue to reduce the environmental impact of the flexen® PE would be to continue to diversify our energy sources by switching more and more to renewable energies. To this end, after having greatly increased the number of photovoltaic panels, The production plant will acquire a cogeneration system. Looking for

more eco-responsible suppliers must also be put in place, as well as finding raw materials manufactured locally to avoid long-distance transport
as much as possible. An analysis of the plant's carbon footprint, which is currently being carried out, should identify areas for improvement and find solutions to achieve the goal of zero carbon.

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/m^3
(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/m^3 TVOC after 28 days. Certificates are available on request. 7.1 VOC emissions
For products used in indoor applications.
Test procedure to AgBB diagram indicating the measuring agency, date and results as a range of values. At least the following must be declared:

7.2 Leaching
According to *EN13468* the content of water-soluble chloride ions for flexen® PE is <10mg/kg

8. References

EN 1602
EN 1602: 2013: Thermal insulating products for building applications - Determination of the apparent density

EN ISO 8497
EN ISO 8497: Thermal insulation - Determination of steady-state thermal transmission properties of thermal insulation for circular pipes

ISO 9001
ISO 9001: 2015: Quality management systems.

EN 13472
EN 13472 : Thermal insulating products for building equipment and industrial installations - Determination of short term water absorption by partial immersion of preformed pipe insulation

EN 13468
EN 13468 : Thermal insulating products for building equipment and industrial installations - Determination of trace quantities of water-soluble chloride, fluoride, silicate, and sodium ions and pH

EN 13501-1
EN 13501-1:2007+A1: 2013 Fire classification of construction products and building elements - Classification using test data from reaction to fire tests

ISO 14001
ISO 14001: 2015 Environmental management systems.

EN ISO 14025
EN ISO 14025: 2011-10: Environmental labels and declarations — Type III environmental declarations — Principles and procedures

ISO 14040
ISO 14040: Environmental management — Life cycle assessment — Principles and framework

ISO 14044
ISO 14044: Environmental management — Life cycle assessment — Requirements and guidelines

EN 14707
EN 14707: 2012: Thermal insulating products for building equipment and industrial installations. Determination of maximum service temperature for preformed pipe insulation

EN 15804
EN 15804: 2012-04 + A1 2014: Sustainability of construction works — Environmental Product Declarations — Core rules for the product category of construction products

CEN/TR 15941
CEN/TR 15941: Sustainability of construction works - Environmental product declarations - Methodology for selection and use of generic data

CEN TS 16516
CEN TS 16516: AgBB, ISO 16000-3, /ISO 16000-6/, /ISO16000-9/, /ISO 16000-11/ Construction products - Assessment of release of dangerous substances. Determination of emissions into indoor air

EN 16783: 2017
EN 16783: 2017 Thermal insulation products - Product category rules (PCR) for factory made and in-situ formed products for preparing environmental product declarations

Candidate list substances of very high concern
SVCH: date: 08.07.2021) exceeding 0.1 percentage by mass

CEFEP
CEFEP: European group of PEF and FEF manufacturers

Eurostat
European Statistics: Recovery rates for packaging waste Paper and cardboard packaging for the European Union 27 countries 2014
http://ec.europa.eu/eurostat/home

Eurofins
Eurofins: Eurofins Scientific is a group of international life sciences companies which provide a unique range of analytical testing services to clients across multiple industries, http://www.eurofins.com

Gabi ts
GaBi 10 GaBi Software-System and Database for Life Cycle Engineering Copyright © 1992-2021 Sphera Solutions Gmbh Version: 10.5.0.78 DB Schema 8007

Institut Bauen und Umwelt
Institut Bauen und Umwelt e.V., Berlin(pub.): General Instructions for the EPD Programme of Institut Bauen und Umwelt e.V., Version 2.0 2021.

Ordinance on Biocide Products: No. 528/2012

Product Category Rules for Building-Related Products and Services
Institute Construction and Environment e.V. (IBU)
Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Project Report
Version 1.7

PCR Guidance-Texts for Building-Related Products and Services
From the range of Environmental Product Declarations of Institute Construction and Environment e.V. (IBU)
Part B: Requirements on the EPD for Insulating materials made of foam plastics
Version 1.6 (Template) Version 1.2 (PCR specific)

REACH
According the European Chemicals Regulation *REACH* manufacturers, importers and downstream users must register their chemicals and are responsible for their safe use.

Sphera
Sphera Solutions Gmbh. GaBi 10 LCI documentation.
GaBi Databases (sphera.com) Stuttgart.
The literature referred to in the Environmental Product Declaration must be listed in full.Standards already fully quoted in the EPD do not need to be listed here again.
The current version of PCR Part A and PCR Part B of the PCR document on which they are based must be referenced.

Publisher

Institut Bauen und Umwelt e.V.
Hegelplatz 1
10117 Berlin
Germany

+49 (0)30 3087748- 0
info@ibu-epd.com
www.ibu-epd.com

Programme holder

Institut Bauen und Umwelt e.V.
Hegelplatz 1
10117 Berlin
Germany

+49 (0)30 3087748- 0
info@ibu-epd.com
www.ibu-epd.com

Author of the Life Cycle Assessment

Owner of the Declaration

Adolf Würth GmbH & Co. KG
Reinhold-Würth-Str. 12-17
74653 Künzelsau
Germany

+49 7940/15-0
info@wuerth.com
www.wuerth.de