REHAU®
Unlimited Polymer Solutions


# ENVIRONMENTAL PRODUCT DECLARATION

## Crosslinked Polyethylene (Pex) Pipe System

# RAUTITAN HEATING AND PLUMBING SYSTEM


**RAUTITAN Plumbing System for drinking water installation**
Drinking water should come from the tap clean and fresh. RAUTITAN offers an extensive product range of polymer material pipes and fittings for this, as well as metall fittings high quality.

**The system can also be used for heating applications**
RAUTITAN brings comforting warmth to every room – with robust components, which are also impressive with their attractive appearance at all visible points. RAUTITAN has solutions for every type of installation – whether the radiator connection is through the wall, the floor or the skirting board.

Following EPD (environmental product declaration) applies for the pipes RAUTITAN flex and RAUTITAN his made of PE-X and used in drinking water installations.

For RAUTITAN stabil in drinking waterinstallation please consult the document DHI00349.


**European Communication Format – B2B**

# Environmental Product Declaration

**Crosslinked polyethylene (PEX) pipe system for hot and cold water in the building**

# 1 DECLARATION OF GENERAL INFORMATION

## Introduction

The European Plastics Pipes and Fittings Association (TEPPFA) deems it important to have an insight into the integral environmental impacts that are encountered during the life-span of particular pipe system applications. With this framework in mind, in 2010 TEPPFA has set up an LCA/EPD project with the Flemish Institute for Technological Research (VITO) which resulted in an EPD. The present EPD is the update of the EPD issued in 2011 – foreground data remained the same, with only the datasets being updated to the latest available version (Ecoinvent 3.3 replaced Ecoinvent 2 datasets). The present EPD outlines the various environmental aspects which accompany the crosslinked polyethylene (PEX) pipe system for hot and cold water in the building, from the primary extraction of raw materials up to and including the end of life (EoL) treatment after its reference service life time.

## Name and address of manufacturers

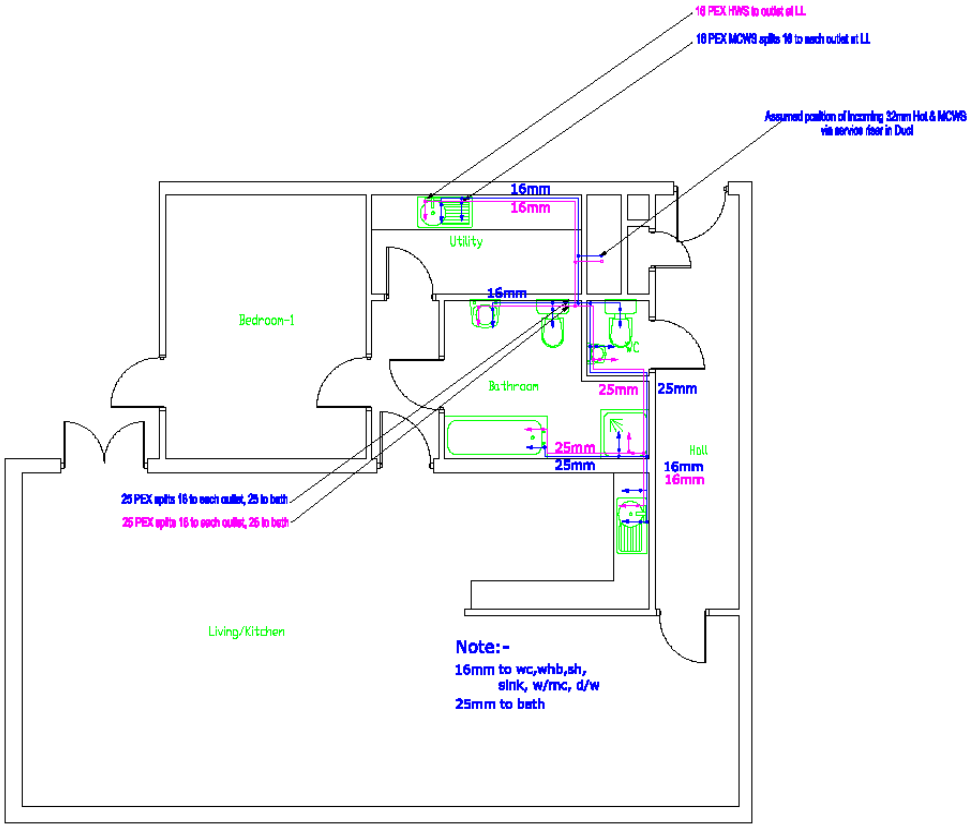
TEPPFA, Avenue de Cortenbergh, 71, B-1000 Brussels, Belgium, Tel: +32-2-736 24 06, Fax: +32-2-736 58 82, E-Mail: info@teppfa.org, Website: www.teppfa.org

## PEX pipe system's use and functional unit

The EPD refers to a typical European crosslinked PEX pipe system for hot and cold water in the building, from the cradle to the grave, including raw material extraction, transportation to converters, converting process, transport to apartment, construction, use and end of life. Environmental indicators are expressed for the complete life cycle, from the cradle to the grave, so for a typical European PEX pipe system. The functional unit is defined as "the pressure supply and transport of hot and cold drinking water, from the entrance of a well-defined apartment to the tap, by means of a PEX Hot & Cold drinking water pipe system installation supplying a 100 m² apartment, incorporating a bathroom, separate WC, kitchen and washroom (considering the service life time of the pipe system to be aligned with the 50 year service life time of the apartment), calculated per year".

## Product name & graphic display of product

PEX pipe system for hot and cold water in the building




## Description of the PEX pipe system's components

The environmental burdens are calculated in relation to the functional unit, which resulted for the typical European PEX pipe system for hot and cold water in the building in the following basic pipe system components: PEX pipes, PPSU and brass fittings.
The typical European PEX pipe system refers to the solid wall, single layer pipe, supplied in coil format. Connections to the several sanitary appliances (e.g. siphons) are not considered. Plastic bodied press fittings in PPSU type material and metal (brass) tie-ins are considered in the life cycle assessment. System components usage by weight is taken as the average of the weights of typical system designs of two major European suppliers. Since systems are normalized, no major weight differences occur. The building system represents 100 m² of a typical residential single family apartment in a 5-storeyed building with all the facilities clearly positioned, like bath, shower etc.
The EPD is declared as the average environmental performance for the typical European PEX pipe system for hot and cold water in the building, over its reference service life cycle of 50 years (being the estimated reference life time of the apartment), in accordance to EN 806, EN 806-2, EN 806-3, EN ISO 15875-1, EN ISO 15875-2 and EN ISO 15875-3.

## EPD programme and programme operator

The EPD developed in 2011 was complying with the EN 15804 norm as it was available at that time. In the meanwhile the EN 15804:2012 +A1:2013 norm was updated. The aspects that differ in the two versions of the EN15804 mentioned above, and that have an impact on the EPD for PE piping system are:

- The reporting of the environmental impacts is more detailed in the EN 15804 version from 2012, where the impacts are reported per each lifecycle stage (A1, A2… to C4 and module D), while in the version valid in 2011 the reporting was done on stages (Product stage, Construction stage, Use stage and End of life stage)

- The method has been better defined with the elementary flows for each impact category updated in the latest version.
- The environmental parameters describing resource input to be reported has changed.

Considering that TEPPFA is using these EPDs for B2B communication, with knowledge already established in the use of EPDs both for TEPPFA members and its clients, TEPPFA is for the moment interested to keep the existing format of the EPD for countinuity of information reasons.

For the calculation of the environmental impacts the method used will be CML IA baseline v.3.03, the latest version provided in SimaPro. Also the environmental parameters reported are in line with the new EN 15804:2012+A1:2013 norm. This ensures that the reported results are in line with the up to date methodological requirements.

This EPD is not registered in any specific EPD programme.

### Date of declaration and validity
March, 2017
The EPD has a 5 year validity period (March, 2022)

### Comparability
Please note that EPDs of construction products may not be comparable if they do not comply with the CEN TC 350 (EN15804 and EN15942) standards.

### Typical European PEX pipe system EPD
The present EPD outlines various environmental aspects which accompany a representative typical European PEX pipe system for hot and cold water in the building, from the primary extraction of raw materials up to and including the end of life (EoL) treatment after its reference service life time of 50 years (considering the service life time of the pipe system to be aligned with the 50 year service life time of the apartment).

### Group of manufacturers
The EPD for the PEX hot and cold pipe system is representative for an anticipated European typical PEX hot and cold pipe system. The TEPPFA member companies represent more than 50% of the European market for extruded plastic pipes. For an overview of all members and national associations within TEPPFA we refer to the last page of this EPD.

### Content of the product system
The product system does not contain materials or substances that can adversely affect human health and the environment in all stages of the life cycle.

### Retrieve information
Explanatory material may be obtained by contacting TEPPFA (http://www.teppfa.org)

# 2 DECLARATION OF THE MATERIAL CONTENT

The European crosslinked polyethylene (PEX) Hot and Cold pipe system does not contain any substances as such or in concentration exceeding legal limits, which can adversely affect human health and the environment in any stages of its entire life cycle.

# 3 DECLARATION OF THE ENVIRONMENTAL PARAMETERS DERIVED FROM LCA

## 3.1 Life cycle flow diagram

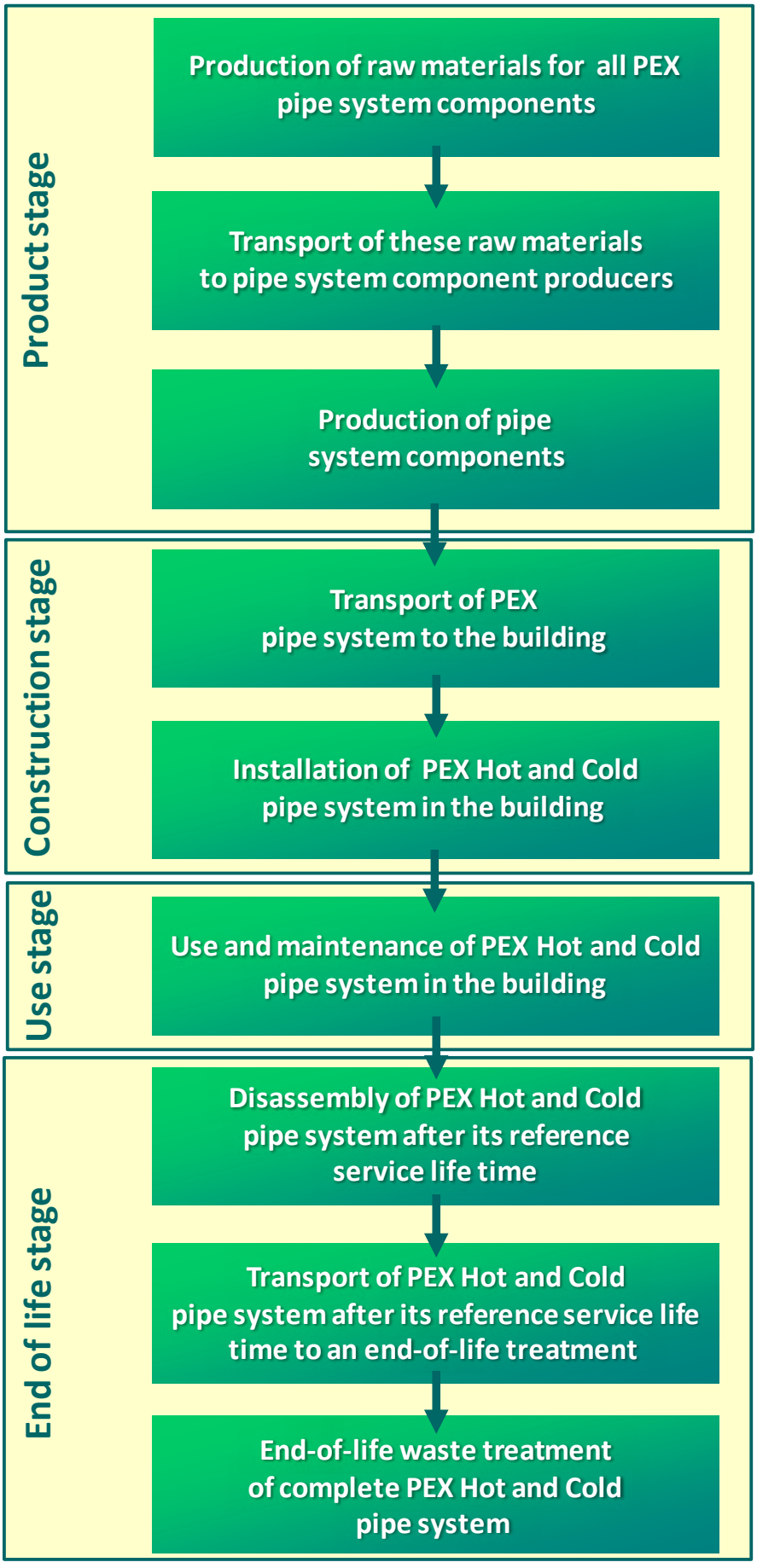
The EPD refers to a typical European PEX Hot and Cold pipe system, from the cradle to the grave, including product stage, transport to construction site and construction process stage, use stage and end of life stage.

- **Product stage**: raw material extraction and processing, recycling processes for recycled material input, transport to the manufacturer, manufacturing (including all energy provisions, waste management processes during the product stage up to waste for final disposal):
  - Production of raw materials for PEX pipes
  - Transport of PEX raw materials to converter
  - Converting process for PEX Hot and Cold pipes (extrusion), including packing of the pipes
  - Production of PPSU fittings
  - Production of brass fittings

- **Construction process stage**: including all energy provisions, waste management processes during the construction stage up to waste for final disposal
  - Transport of PEX Hot and Cold pipe system to the building
  - Installation of PEX Hot and Cold pipe system to the building

- **Use stage** (maintenance and operational use): including transport and all energy provisions, waste management processes up to waste for final disposal during this use stage
  - Operational use is not relevant for the PEX Hot and Cold pipe system
  - Maintenance is not relevant for the PEX Hot and Cold pipe system

- **End of life stage**: including all energy provisions during the end of life stage
  - Disassembly of PEX Hot and Cold pipe system after 50 years of reference service life time at the building
  - Transport of PEX Hot and Cold pipe system after 50 years of reference service life time at the building to an end-of-life treatment
  - End-of-life treatment of PEX Hot and Cold pipe system


Product stage
Production of raw materials for all PEX pipe system components
Transport of these raw materials to pipe system component producers
Production of pipe system components
Construction stage
Transport of PEX pipe system to the building
Installation of PEX Hot and Cold pipe system in the building
Use stage
Use and maintenance of PEX Hot and Cold pipe system in the building
End of life stage
Disassembly of PEX Hot and Cold pipe system after its reference service life time
Transport of PEX Hot and Cold pipe system after its reference service life time to an end-of-life treatment
End-of-life waste treatment of complete PEX Hot and Cold pipe system

## 3.2 Parameters describing environmental impacts

The following environmental parameters are expressed with the impact category parameters of the life cycle impact assessment (LCIA).

| Impact category | Abiotic depletion | Abiotic depletion (fossil fuels) | Acidification | Eutrophication | Global warming | Ozone layer depletion | Photochemical oxidation |
|---|---|---|---|---|---|---|---|
| | kg Sb eq | MJ | kg SO2 eq | kg PO4--- eq | kg CO2 eq | kg CFC-11 eq | kg C2H4 eq |
| Product stage | 4,49E-05 | 1,72E+01 | 5,67E-03 | 1,59E-03 | 6,56E-01 | 6,74E-08 | 4,11E-04 |
| Construction process stage | 3,37E-07 | 1,68E+00 | 6,25E-04 | 8,47E-05 | 1,55E-01 | 1,33E-08 | 5,83E-05 |
| Use stage | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| End of life stage | -3,24E-09 | -2,36E-01 | -8,18E-05 | -2,35E-06 | 6,01E-02 | -1,82E-09 | -4,89E-06 |
| **Total** | **4,52E-05** | **1,86E+01** | **6,22E-03** | **1,67E-03** | **8,71E-01** | **7,89E-08** | **4,64E-04** |

## 3.3 Parameters describing resource input

The following environmental parameters apply data based on the life cycle inventory (LCI).

| Environmental parameter | Use of renewable primary energy excluding renewable primary energy resources used as raw materials | Use of renewable primary energy resources used as raw materials | Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials) | Use of non renewable primary energy excluding non renewable primary energy resources used as raw materials | Use of non renewable primary energy resources used as raw materials | Total use of non renewable primary energy resources (primary energy and primary energy resources used as raw materials) | Use of secondary material | Use of renewable secondary fuels | Use of non renewable secondary fuels | Net use of fresh water |
|---|---|---|---|---|---|---|---|---|---|---|
| | MJ, net calorific value | MJ, net calorific value | MJ, net calorific value | MJ, net calorific value | MJ, net calorific value | MJ, net calorific value | kg | MJ, net calorific value | MJ, net calorific value | m3 |
| Product stage | na | na | 9,89E-01 | na | na | 1,94E+01 | na | na | na | 1,29E-03 |
| Construction process stage | na | na | 8,79E-02 | na | na | 2,08E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| Use stage | 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 | 0,00E+00 |
| End of life stage | na | na | -8,88E-02 | na | na | -5,97E-01 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| **Total** | **0,00E+00** | **0,00E+00** | **9,88E-01** | **0,00E+00** | **0,00E+00** | **2,09E+01** | **0,00E+00** | **0,00E+00** | **0,00E+00** | **1,29E-03** |

## 3.4 Parameters describing different waste categories and further output material flows

The parameters describing waste categories and other material flows are output flows derived from the life cycle inventory (LCI)

### Parameters describing different waste categories

| Environmental parameter | Hazardous waste | Non-hazardous waste | Nuclear waste |
|---|---|---|---|
| | kg | kg | kg |
| Product stage | 1,20E-02 | 1,05E-01 | 2,95E-05 |
| Construction stage | 8,75E-06 | 4,82E-02 | 7,45E-06 |
| Use stage | 0,00E+00 | 1,00E+00 | 2,00E+00 |
| End of life stage | -5,91E-07 | 1,60E-01 | -3,17E-06 |
| **Total** | **1,20E-02** | **1,31E+00** | **2,00E+00** |

### Parameters describing further output material flows

| Parameter | Parameter unit expressed per functional unit |
|---|---|
| Components for re-use | 0 kg |
| Materials for recycling | 0,022 kg |
| Materials for energy recovery | 0,027 kg |

# 4 SCENARIOS AND TECHNICAL INFORMATION

## 4.1 Construction process stage

### Transport from the production gate to the construction site (apartment)

| Parameter | Parameter unit expressed per functional unit |
|---|---|
| Fuel type consumption of vehicle or vehicle type used for transport e.g. long distance truck, boat etc. | The PEX hot and cold pipe system is transported over an average distance of 800 km with a truck (about 16 ton) and 30 km by means of a van (< 3,5 ton) from the producers of the different pipe system components via customers to the building. Environmental burdens associated with this kind of transport are calculated by means of the Ecoinvent V3.3 datarecords "Transport, freight, lorry 16-32 metric ton, EURO4 {RER}\| transport, freight, lorry 16-32 metric ton, EURO4 \| Alloc Rec, U" and "Transport, freight, light commercial vehicle {Europe without Switzerland}\| processing \| Alloc Rec, U". |
| Capacity utilisation (including empty returns) | |
| Bulk density | |
| Volume capacity utilisation factor (factor: =1 or <1 or ≥ 1 for compresse or nes ed packaged products) | |

### Construction (installation in building/apartment)

| Parameter | Parameter unit expressed per functional unit |
|---|---|
| Ancillary materials for installation | **3 liter of water** for testing, flushing and cleaning.<br>**0,04 kg fast fixing cement** (ratio water/cement 0,3) of which 0,028 kg cement and 0,012 kg water<br>**0,03 kg of wall fixing metals**, considered to be made out of galvanised steel<br>Environmental burdens associated with this kind of input flows are calculated by means of the Ecoinvent V3.3 datarecord "Tap water {RER}\| market group for \| Alloc Rec, U", "Cement, unspecified {Europe without Switzerland}\| production \| Alloc Rec, U" and "Steel, unalloyed |

| | |
|---|---|
| | {RER}| steel production, converter, unalloyed | Alloc Rec, U", in combination with Metal working, average for steel product manufacturing {RER}| processing | Alloc Rec, U" |
| Other resource consumption | Not relevant |
| Quantitative description of energy type (regional mix) and consumption during the installation process | **0,01 kWh of electrical energy** is needed for the installation (screw driver)<br>Environmental burdens associated with this kind of energy are calculated by means of the Ecoinvent V3.3 datarecord "Electricity, low voltage {RER}| market group for | Alloc Rec, U" (European average mix of production) |
| Waste on the building site, generated by the product's installation | **0,0016 kg of PEX pipe left left over** during installation: 85% to landfill and 15% to incineration. Transportation of PEX pipe left over to waste management treatment facilities is included: 150 km to incineration with energy recovery and 50 km to landfill. Environmental burdens are calculated by means of the Ecoinvent V3.3 datarecord "Transport, freight, lorry 3.5-7.5 metric ton, EURO4 {RER}| transport, freight, lorry 3.5-7.5 metric ton, EURO4 \| Alloc Rec, U".<br>**0,014 kg of packaging waste**: treated according to European average packaging waste scenarios (EU27, 2006): |
| Output materials as result of waste management processes at the building site e.g. of collection for recycling, for energy recovery, final disposal | |
| Emissions to ambient air, soil and water | No direct emissions at the trench. Emissions are related to the upstream processes (mining of sand, transportation processes and mechanical energy) and downstream processes (waste management and treatment) and are included in the Ecoinvent datarecords that are used for modelling the environmental impacts. |

| | Recycling | Energy Recovery | Landfill |
|---|---|---|---|
| Plastic | 27% | 26% | 47% |
| Paper and board | 75% | 10% | 15% |
| Wood | 38% | 23% | 39% |
| Metals | 66% | | 34% |
| **Total** | **57%** | **12%** | **31%** |

## 4.2 Use stage: operation and maintenance

### Operation and maintenance:

Operational use (pumping energy) is not relevant for the EPD, since it falls outside the system boundaries of the LCA project. Maintenance is not needed for the PEX Hot and Cold pipe system.

## 4.3 End of life

The following end of life scenarios have been taken into account:

- Estimated reference service life time of 50 years, being the service life time of the apartment

- EoL approach for landfill, incineration with energy recovery (impacts and credits are assigned to the life cycle that generates the waste flows)
- Recycled content approach for recycling and use of recyclates (= impact of recycling and credits for recyclates, because less virgin materials are needed is assigned to the life cycle that uses the recyclates)

<table>
<tr><th>Processes</th><th>Parameter unit expressed per functional unit</th></tr>
<tr><td>Collection process<br>Recycling system<br>Final deposition</td><td>After a reference service life time of 50 years the PEX hot and cold pipe system is stripped for recoverable materials and products, and the remaining construction subsequently demolished. The PEX Hot & Cold water pipe system is demolished together with the total construction. So for the functional unit 0,207 kg of pipe system components are available at the apartment. The brass fittings (0,030 kg) are for 75% recycled (0,022 kg is transported over average distance of 600 km) and for 25% disposed to a landfill (0,007 kg transported over average distance of 50 km). The PEX pipes and PPSU fittings (0,177 kg) follow the following scenario: 15% (0,027 kg) is transported over an average distance of 150 km to an incinerator and 85% (0,151 kg) is transported over an average distance of 50 km to a landfill.<br><br>
<table>
<tr><th>EOL scenario PEX pipes</th><th>Present</th></tr>
<tr><td>Mechanical recycling</td><td>0%</td></tr>
<tr><td>Incineration</td><td>15%</td></tr>
<tr><td>Landfill</td><td>85%</td></tr>
</table>
<br>Environmental burdens associated with transportation are calculated by means of the following Ecoinvent V3.3 datarecord “Transport, freight, lorry 3.5-7.5 metric ton, EURO4 {RER}| transport, freight, lorry 3.5-7.5 metric ton, EURO4 | Alloc Rec, U”</td></tr>
</table>

# 5 ADDITIONAL INFORMATION ON EMISSIONS TO INDOOR AIR, SOIL AND WATER DURING USE STAGE

Emissions to indoor air:
Despite there is no approved European measurement method available, we can confirm that the PEX Hot and Cold pipe system does not contain any substances mentioned on the REACH-list.

Emissions to soil and water:
Since the PEX hot and cold pipe system is installed in the apartment we can confirm that emissions to soil and water are not relevant.

# 6 OTHER ADDITIONAL INFORMATION

## Product certification, conformity, marking

**EN 806-1**, Specifications for installations inside buildings conveying water for human consumption. Part 1: General

**EN 806-2**, Specification for installations inside buildings conveying water for human consumption. Part 2: Design

**EN 806-3**, Specifications for installations inside buildings conveying water for human consumption. Part 3: Pipe sizing. Simplified method

**EN ISO 15875-1**, Plastics piping systems for hot and cold water installations. Crosslinked polyethylene (PE-X). Part 1: General

**EN ISO 15875-2**, Plastics piping systems for hot and cold water installations. Crosslinked polyethylene (PE-X). Part 2: Pipes

**EN ISO 15875-3**, Plastics piping systems for hot and cold water installations. Crosslinked polyethylene (PE-X). Part 3: Fittings

In compliance with European Construction Products Directive (89/106/EEC)

## Other technical product performances

For the full overview of the environmental benefits of plastic pipe systems we will refer to the TEPPFA website: http://www.teppfa.org

## List of names and logos of TEPPFA member companies

| | |
|---|---|
| Aliaxis | **Aliaxis** |
| ALPHACAN ARKEMA GROUP | **Alphacan** |
| egeplast | **EGEPLAST** |
| GEBERIT | **Geberit International** |
| +GF+ GEORG FISCHER PIPING SYSTEMS | **Georg Fischer Piping Systems** |
| KWH PIPE | **KWH Pipe** |
| PIPELIFE | **Pipelife International** |
| REHAU Unlimited Polymer Solutions | **Rehau** |
| TeraPlast | **Teraplast** |
| TESSENDERLO GROUP | **Tessenderlo Group** |
| uponor | **Uponor** |
| wavin | **Wavin** |

## List of National Associations of TEPPFA

| | | |
|---|---|---|
| **ADPP** | - | Czech Republic plastic pipes association |
| **ASETUB** | - | Asociación Española de Fabricantes de Tubos y Accesorios Plásticos |
| **BPF** | - | Plastic Pipes Group |
| **BPPMA** | - | Bulgarian Plastic Pipes Manufacturers Association |
| **BureauLeiding** | - | Dutch Plastic Pipes Association |
| **DPF** | - | Danish Plastics Federation |
| **FCIO** | - | Fachverband der Chemischen Industrie Österreich |
| **Federplast.be** | - | Belgische Vereniging van Producenten van Kunststof- en Rubberartikelen bij Agoria en |
| **FIPIF** | - | Finnish Plastics Industries Federation |
| **IPPMA** | - | Irish Plastic Pipe Manufacturers Association |
| **KRV** | - | Kunstoffrohrverband e.V.- Fachverband der Kunstoffrohr-Industrie |
| **MCsSz** | - | Műanyag Csőgyártók Szövetsége |
| **P&K** | - | Swedish Plastics and Chemical Federation |
| **PRIK** | - | Polish Association of Pipes and Fittings |
| **STR** | - | Syndicat des Tubes et Raccords |
| **VKR** | - | Verband Kunststoffrohre und Rohrleitungstelle |

# REFERENCES


EN 806-1, Specifications for installations inside buildings conveying water for human consumption. Part 1: General

EN 806-2, Specification for installations inside buildings conveying water for human consumption. Part 2: Design

EN 806-3, Specifications for installations inside buildings conveying water for human consumption. Part 3: Pipe sizing. Simplified method

EN ISO 15875-1, Plastics piping systems for hot and cold water installations. Crosslinked polyethylene (PE-X). Part 1: General

EN ISO 15875-2, Plastics piping systems for hot and cold water installations. Crosslinked Polyethylene (PE-X). Part 2: Pipes

EN ISO 15875-3, Plastics piping systems for hot and cold water installations. Crosslinked polyethylene (PE-X). Part 3: Fittings

Eurostat, 2006, Packaging waste scenarios (EU27, 2006)

ISO 14025: Environmental Labels and Declarations Type III

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

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

prEN 15804: Sustainability of construction works – Environmental product declarations – core rules for the product category of construction products (draft, 2008)

EN 15804:2012+A1:2013: Sustainability of construction works – Environmental product declarations – core rules for the product category of construction products (2013)

prEN 15942: Sustainability of construction works – Environmental product declarations – Communication format – Business to Business (draft, April 2009)



**Background LCA report (ISO 14040 and ISO 14044) prepared by**

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**External critical review of underlying LCA by**

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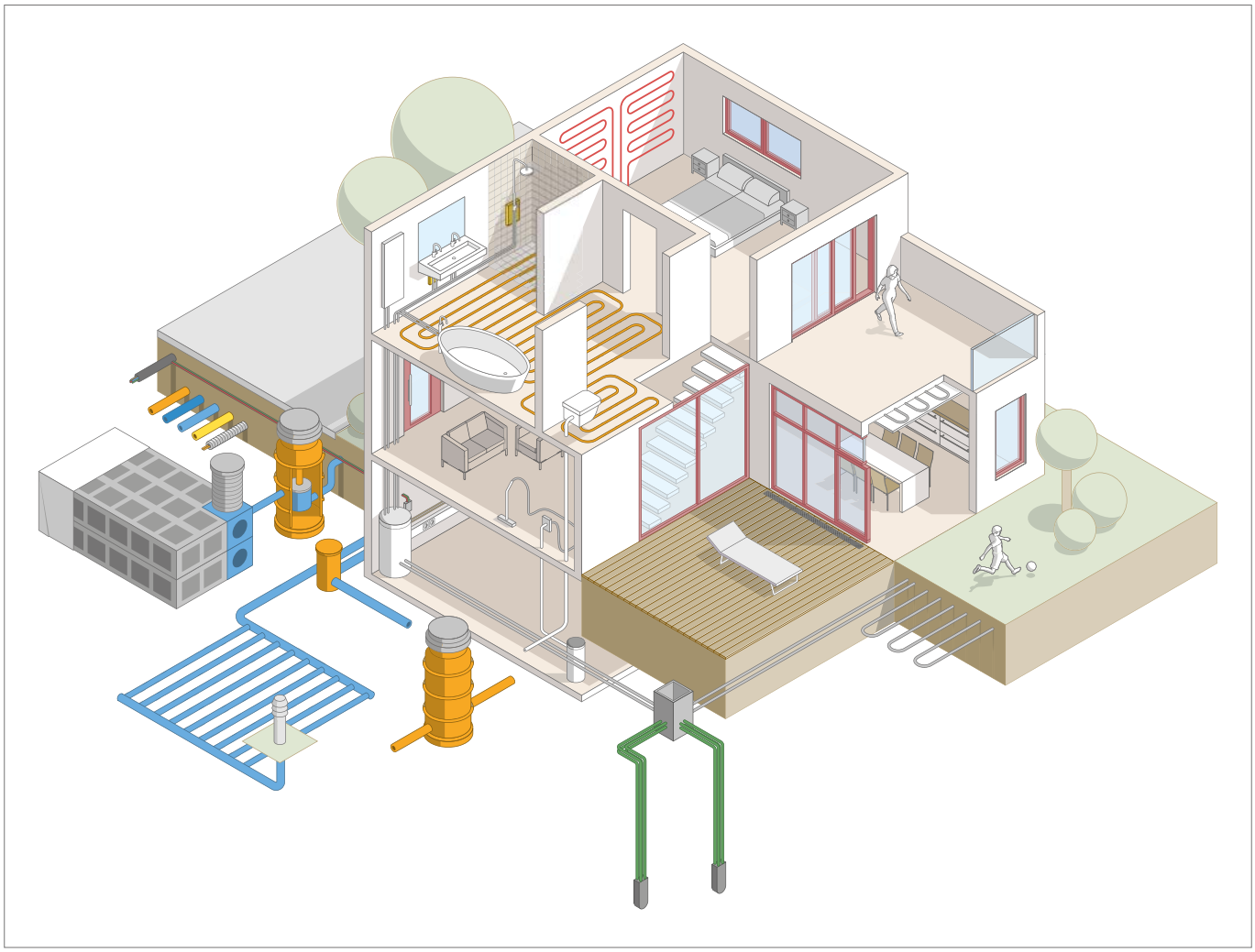



Our verbal and written advice with regard to usage is based on years of experience and standardised assumptions and is provided to the best of our knowledge. The intended use of REHAU products is described comprehensively in the technical product information. The latest version can be viewed at www.rehau.com/TI. We have no control over the application, use or processing of the products. Responsibility for these activities therefore remains entirely with the respective user/processor.
Where claims for liability nonetheless arise, they shall be governed exclusively according to our terms and conditions, available at www.rehau.com/conditions, insofar as nothing else has been agreed upon with REHAU in writing. This shall also apply for all warranty claims, with the warranty applying to the consistent quality of our products in accordance with our specifications. Subject to technical changes.

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