



**European Communication
Format – B2B**

**Environmental
Product Declaration**

**Polyvinylchloride (PVC-U)
pipe system for soil and
waste removal 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 2012 – foreground data remained the same, with only the datasets being updated to the latest available version in Life Cycle Inventory Databases (ecoinvent 3.3 and Industry 2.0). The present EPD outlines the various environmental aspects which accompany the polyvinylchloride (PVC-U) pipe system for soil and waste removal 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

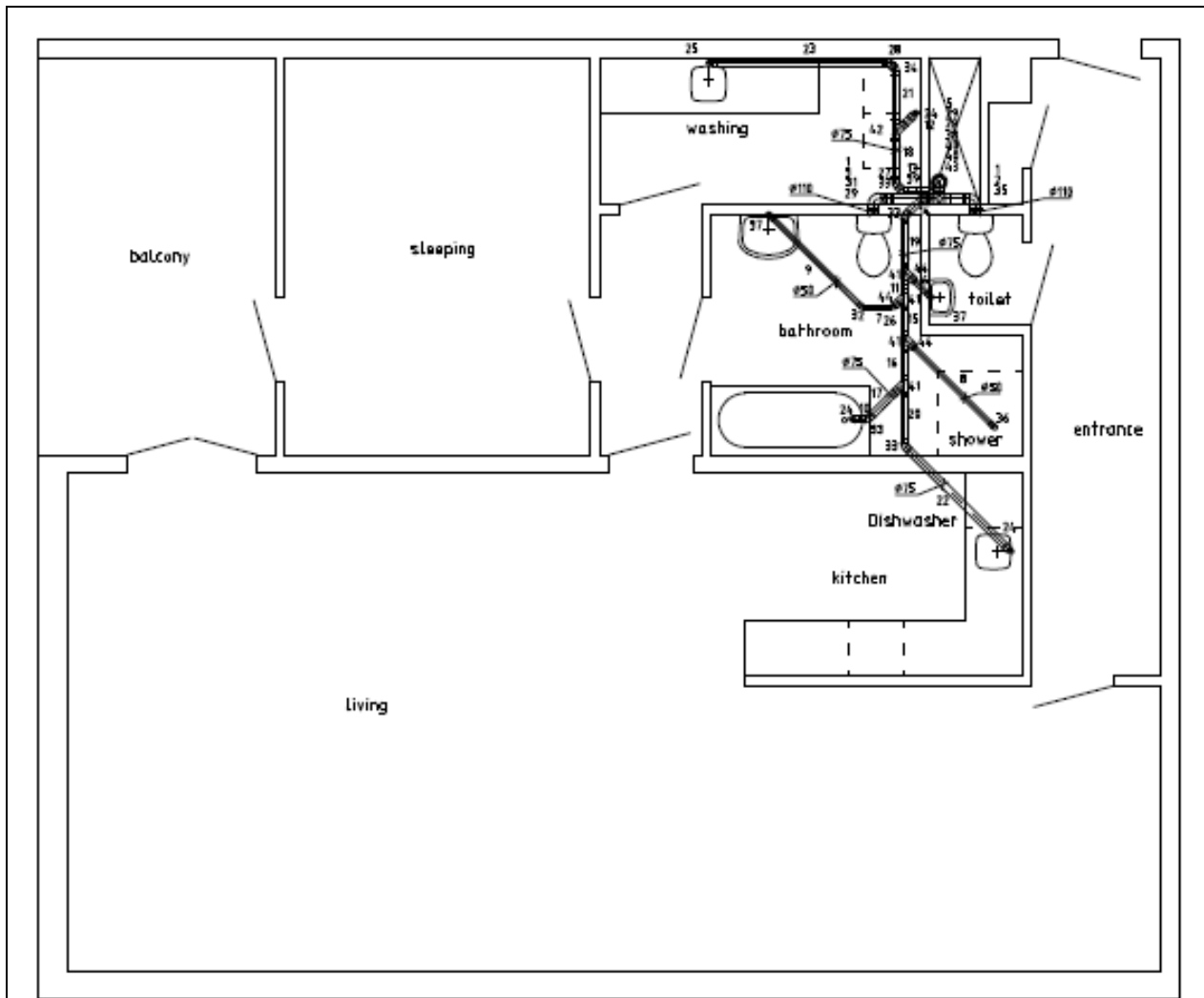
TEPPFA, Avenue de Cortenbergh, 71, B-1000 Brussels, Belgium, Tel: +32-2-736 24 06, Fax: +32-2-736 58 82, E-Mail: info@teppfa.eu, Website: www.teppfa.eu

PVC-U pipe system's use and functional unit

The EPD refers to a typical European PVC-U pipe system for soil and waste removal 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 PVC-U pipe system. The functional unit is defined as "the gravity discharge and transport of soil and waste, from a well-defined apartment to the entrance of a public sewer system, and this by means of a PVC-U Soil and Waste gravity drainage system, installation into the 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 life of the apartment), calculated per year".

Product name & graphic display of product

PVC-U pipe system for soil and waste removal from the building



Description of the PVC-U pipe system's components

The environmental burdens are calculated in relation to the functional unit, which resulted for the typical European PVC-U pipe system for soil and waste removal in the building in the following basic pipe system components: PVC-U pipes, PVC-U fittings and SBR sealing rings. The PVC-U Soil & Waste system is designed according to EN 12056-2 "Gravity drainage systems inside buildings – part 2: Sanitary pipe work, layout and calculation". The components of the PVC-U-systems, pipes and fittings, are in accordance with EN 1329 "Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure - Unplasticized polyvinylchloride (PVC-U) - Part 1: Specifications for pipes, fittings and the system". The PVC-U Soil & Waste pipe system is designed for application area "B" within the building structure (B-application). 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 a typical European PVC-U pipe system for soil and waste, over its reference service life cycle of 50 years (being the estimated reference life time of the apartment), calculated per year, in accordance to EN 12056-1, EN 12056-2 and EN 1329.

EPD programme and programme operator

The EPD developed in 2012 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 the PVC 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 continuity of information reasons.

The method used for the calculation of the environmental impacts is CML IA baseline v.3.03, the latest version provided in the calculation program 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

January, 2018

The EPD has a 5 year validity period (January, 2023)

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 PVC-U pipe system EPD

The present EPD outlines various environmental aspects which accompany a representative typical European PVC-U pipe system for soil and waste removal from 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 PVC-U Soil and Waste pipe system is representative for an anticipated European typical PVC-U Soil and Waste 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.eu>)

2 DECLARATION OF THE MATERIAL CONTENT

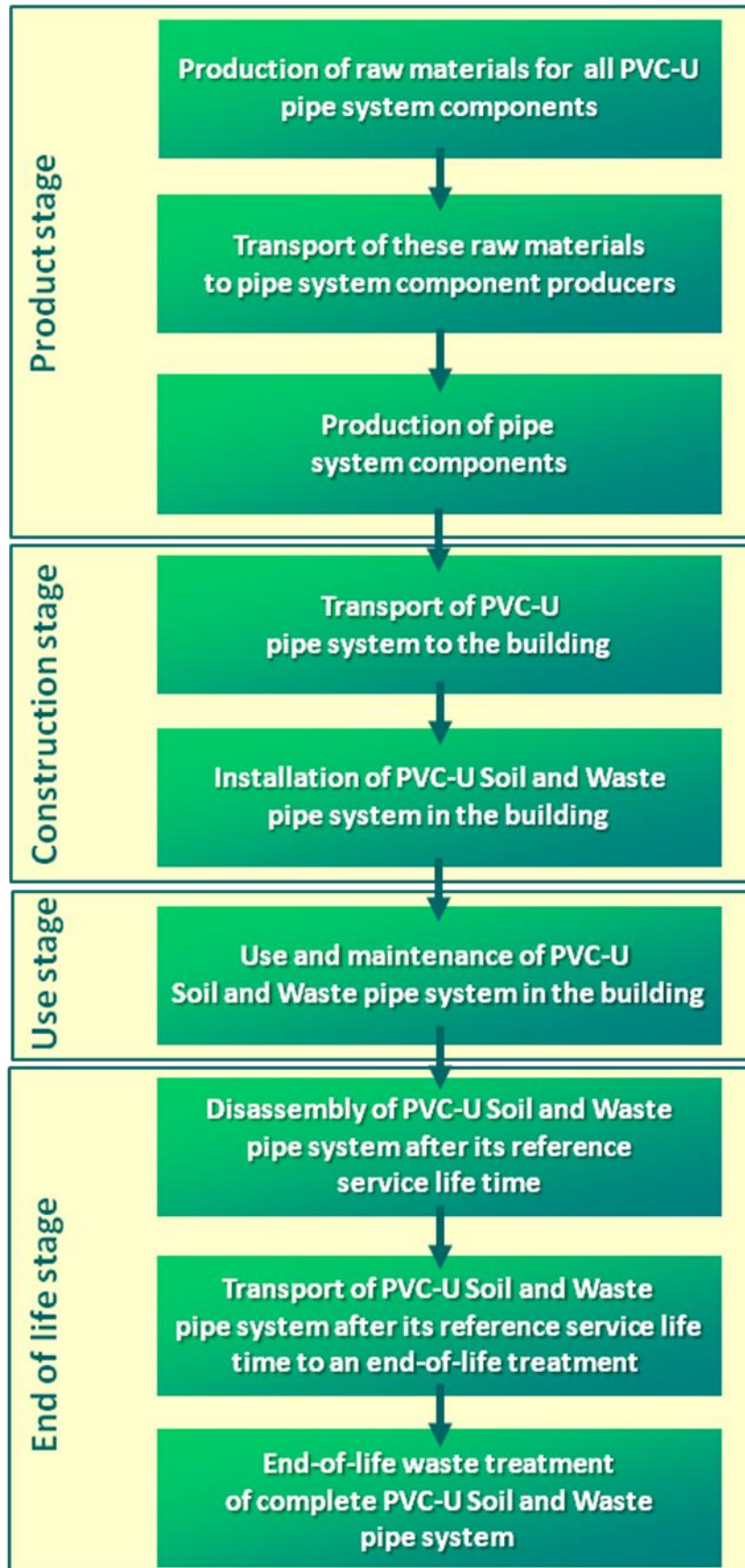
The European polyvinylchloride (PVC-U) Soil and Waste pipe system does not contain any substances as such or in concentration exceeding legal limits, which can adversely affect human health and the environment in any stages of its entire life cycle.

3 DECLARATION OF THE ENVIRONMENTAL PARAMETERS DERIVED FROM LCA

3.1 Life cycle flow diagram

The EPD refers to a typical European PVC-U Soil and Waste 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 PVC-U pipes
 - Transport of PVC-U raw materials to converter
 - Converting process for PVC-U Soil and Waste pipes (extrusion)
 - Production of raw materials for PVC-U fittings
 - Transport of PVC-U fittings raw materials to converter
 - Converting process for PVC-U fittings (injection moulding)
 - Production of SBR sealing rings (raw materials + converting process)
 - Production of solvent cement
 - Production of cleaning agent
- **Construction process stage:** including all energy provisions, waste management processes during the construction stage up to waste for final disposal
 - Transport of PVC-U Soil and Waste pipe system to the building
 - Installation of PVC-U Soil and Waste 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
 - Use and maintenance of the complete PVC-U Soil and Waste pipe system during 50 years of reference service life time of the apartment
- **End of life stage:** including all energy provisions during the end of life stage
 - Disassembly of the complete PVC-U Soil and Waste pipe system after 50 years of reference service life time at the building
 - Transport of the complete PVC-U Soil and Waste pipe system after 50 years of reference service life time at the building to an end-of-life treatment
 - End-of-life treatment of complete PVC-U Soil and Waste 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 non-fossil	Abiotic depletion (fossil fuels)	Acidification	Eutrophication	Global warming	Ozone layer depletion	Photochemical oxidation
	kg Sb eq	MJ	kg SO ₂ eq	kg PO ₄ — eq	kg CO ₂ eq	kg CFC-11 eq	kg C ₂ H ₄ eq
Product stage	7,21E-06	3,01E+01	3,64E-03	6,66E-04	1,32E+00	5,08E-07	2,64E-04
Construction process stage	9,69E-07	3,20E+00	8,66E-04	1,50E-04	2,35E-01	3,25E-08	5,79E-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	1,05E-07	1,57E-01	2,28E-05	1,54E-05	1,20E-01	2,88E-09	1,50E-06
Total	8,28E-06	3,35E+01	4,53E-03	8,31E-04	1,67E+00	5,44E-07	3,23E-04

3.3 Parameters describing resource input

The following environmental parameters are output flows derived from 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	m ³
Product stage	n.a.	n.a.	3,15E+00	n.a.	n.a.	3,46E+01	n.a.	n.a.	n.a.	1,05E-01
Construction process stage	n.a.	n.a.	8,76E-02	n.a.	n.a.	3,26E+00	n.a.	n.a.	n.a.	9,36E-04
Use stage	n.a.	n.a.	0,00E+00	n.a.	n.a.	0,00E+00	n.a.	n.a.	n.a.	0,00E+00
End of life stage	n.a.	n.a.	-8,64E-02	n.a.	n.a.	-2,40E-01	n.a.	n.a.	n.a.	-3,53E-04
Total	n.a.	n.a.	3,15E+00	n.a.	n.a.	3,76E+01	n.a.	n.a.	n.a.	1,05E-01

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	2,26E-01	7,22E-02	3,54E-05
Construction stage	1,14E-05	1,15E-01	1,82E-05
Use stage	0,00E+00	0,00E+00	0,00E+00
End of life stage	-3,94E-07	5,96E-01	-6,45E-07
Total	2,26E-01	7,83E-01	5,29E-05

Parameters describing further output material flows

Parameter	Parameter unit expressed per functional unit
Components for re-use	0 kg
Materials for recycling	0,028 kg
Materials for energy recovery	0,085 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 PVC-U soil and waste pipe system is transported over an average distance of 480 km with a truck and 30 km by means of a van 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 data records "Transport, freight, lorry 3.5-7.5 metric ton, EURO4 {RER} transport, freight, lorry 3.5-7.5 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 compressed or nested packaged products)	

Construction (installation in building/apartment)

Parameter	Parameter unit expressed per functional unit
Ancillary materials for installation	<p>0,00125 kg of soap (lubricant)</p> <p>0,0094 kg of brackets (2 for the installation) , considered to be made out of galvanised steel</p> <p>0,04 kg fast fixing cement (ratio water/cement 0,3) of which 0,028 kg cement and 0,012 kg water</p> <p>0,002 kg of plastic fixing materials, made out of polypropylene (PP)</p> <p>Environmental burdens associated with this kind of input flows are calculated by means of the Ecoinvent V3.3 data records "Tap water {RER} market group for Alloc Rec, U", "Cement, unspecified {Europe without Switzerland} production Alloc Rec, U", "Soap {RER} production Alloc Rec, U", "Polypropylene, granulate {RER} production Alloc Rec, U" in combination with "Injection moulding {RER} processing 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"</p>

Other resource consumption	Not relevant																								
Quantitative description of energy type (regional mix) and consumption during the installation process	0,008 kWh of electrical energy is needed for the installation (screw driver) Environmental burdens associated with this kind of energy are calculated by means of the Ecoinvent V3.3 data record "Electricity, low voltage {RER} market group for Alloc Rec, U"																								
Waste on the building site, generated by the product's installation	0,008 kg of PVC-U pipe left-over during installation: 80% to landfill, 15% to incineration and 5% to mechanical recycling. Transportation of PVC-U pipe left over to waste management treatment facilities is included: 600 km to recycling plant, 150 km to incineration with energy recovery and 50 km to landfill. Environmental burdens are calculated by means of the Ecoinvent v3.3 data record "Transport, freight, lorry 3.5-7.5 metric ton, EURO4 {RER} transport, freight, lorry 3.5-7.5 metric ton, EURO4 Alloc Rec, U". 0,0672 kg of packaging waste: treated according to European average packaging waste scenarios (EU27, 2006): <table border="1" data-bbox="805 969 1281 1142"> <thead> <tr> <th></th> <th>Recycling</th> <th>Energy Recovery</th> <th>Landfill</th> </tr> </thead> <tbody> <tr> <td>Plastic</td> <td>27%</td> <td>26%</td> <td>47%</td> </tr> <tr> <td>Paper and board</td> <td>75%</td> <td>10%</td> <td>15%</td> </tr> <tr> <td>Wood</td> <td>38%</td> <td>23%</td> <td>39%</td> </tr> <tr> <td>Metals</td> <td>66%</td> <td></td> <td>34%</td> </tr> <tr> <td>Total</td> <td>57%</td> <td>12%</td> <td>31%</td> </tr> </tbody> </table>		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%
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Wood	38%	23%	39%																						
Metals	66%		34%																						
Total	57%	12%	31%																						
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 building site. 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 data records that are used for modelling the environmental impacts.																								

4.2 Use stage: operation and maintenance

Operation and maintenance:

Operational use is not relevant for the EPD, since it falls outside the system boundaries of the LCA project. Maintenance is not needed for the PVC-U soil and waste pipe system. Moreover the PVC-U soil and waste pipe system is a gravity 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)

Processes	Parameter unit expressed per functional unit								
Collection process	<p>After a reference service life time of 50 years the PVC-U soil and waste pipe system is stripped for recoverable materials and products, and the remaining construction subsequently demolished. The PVC-U soil and waste pipe system is demolished together with the total construction. For the functional unit 0,568 kg of pipe system components are available at the apartment: 5% (0,028 kg) is transported over an average distance of 600 km to a recycling plant, 15% (0,085 kg) is transported over an average distance of 150 km to an incinerator, and the remaining 80% (0,455 kg) is transported over an average distance of 50 km to a landfill.</p> <table border="1" data-bbox="687 938 1267 1180"> <thead> <tr> <th colspan="2" data-bbox="687 938 1267 1059">EOL scenario PVC-U pipes</th> </tr> </thead> <tbody> <tr> <td data-bbox="687 1059 1078 1099">Mechanical recycling</td> <td data-bbox="1078 1059 1267 1099">5%</td> </tr> <tr> <td data-bbox="687 1099 1078 1140">Incineration</td> <td data-bbox="1078 1099 1267 1140">15%</td> </tr> <tr> <td data-bbox="687 1140 1078 1180">Left in ground</td> <td data-bbox="1078 1140 1267 1180">80%</td> </tr> </tbody> </table> <p>Environmental burdens associated with transportation are calculated by means of the following Ecoinvent v3.3 data record "Transport, freight, lorry 3.5-7.5 metric ton, EURO4 {RER} transport, freight, lorry 3.5-7.5 metric ton, EURO4 Alloc Rec, U"</p>	EOL scenario PVC-U pipes		Mechanical recycling	5%	Incineration	15%	Left in ground	80%
EOL scenario PVC-U pipes									
Mechanical recycling	5%								
Incineration	15%								
Left in ground	80%								

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 PVC-U Soil and Waste pipe system does not contain any substances mentioned on the REACH-list.

Emissions to soil and water:

Since the PVC-U Soil and Waste 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 12056-1, Gravity drainage systems inside buildings. Part 1: General and performance requirements

EN 12056-2, Gravity drainage systems inside buildings. Part 2: Sanitary pipe work, layout and calculation

EN 1329, Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure - Unplasticized polyvinylchloride (PVC-U) - Part 1: Specifications for pipes, fittings and the system

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 refer to the TEPPFA website: <http://www.teppfa.eu>

List of names and logos of TEPPFA member companies

 Aliaxis

Aliaxis

 **GEBERIT**

Geberit International

 **+GF+** GEORG FISCHER
PIPING SYSTEMS

Georg Fischer Piping Systems

 **PIPELIFE**

Pipelife International

 **Polypipe**

Polypipe

 **RADIUS**
Systems

Radius Systems

 **REHAU**
Unlimited Polymer Solutions

Rehau

 **TESSENDERLO**
GROUP

Tessenderlo Group

 **uponor**

Uponor

 **wavin**

Wavin

List of National Associations of TEPPFA

ASETUB	- Asociación Española de Fabricantes de Tubos y Accesorios Plásticos
BPF	- Plastic Pipes Group
BureauLeiding	- Dutch Plastic Pipes Association
Czech Republic	- Czech Republic plastic pipes association
DPF	- Danish Plastics Federation
FCIO	- Fachverband der Chemischen Industrie Österreich
Federplast	- Belgische Vereniging van Producenten van Kunststof- en Rubberartikelen bij Agoria en Assenscia
FIPIF	- Finnish Plastics Industries Federation
KRV	- Kunststoffrohrverband e.V.- Fachverband der Kunststoffrohr-Industrie
MCsSz	- Műanyag Csőgyártók Szövetsége
PRIK	- Polish Association of Pipes and Fittings
STR	- Syndicat des Tubes et Raccords
Sweden	- Swedish Plastics and Chemical Federation
VKR	- Verband Kunststoffrohre und Rohrleitungstelle
Unionplast/Federazione Gomma Plastica	- Pipes Sector Group

REFERENCES

Ecoinvent, 2016. Ecoinvent database v3.3, Swiss Centre for Life Cycle Inventories, Switzerland. From: www.ecoinvent.org

EN 12056-1, Gravity drainage systems inside buildings. Part 1: General and performance requirements

EN 12056-2, Gravity drainage systems inside buildings. Part 2: Sanitary pipe work, layout and calculation

EN 1329, Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure - Unplasticized poly vinyl chloride (PVC-U) - Part 1: Specifications for pipes, fittings and the system

Eurostat, 2006. Packaging waste scenarios (EU27, 2006). From: http://epp.eurostat.ec.europa.eu/portal/page/portal/waste/data/wastestreams/packaging_waste

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

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

EN 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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