ENVIRONMENTAL PRODUCT DECLARATION
as per ISO 14025 and EN 15804

Owner of the Declaration: PU Europe
Programme holder: Institut Bauen und Umwelt e.V. (IBU)
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Declaration number: EPD-PUE-20130286-CBE1-EN
Issue date: 27.02.2014
Valid to: 26.02.2019

PU thermal insulation board with mineral fleece facing
PU Europe

www.bau-umwelt.com / https://epd-online.com
General Information

PU Europe

Programme holder
IBU - Institut Bauen und Umwelt e.V.
Panoramastr. 1
10178 Berlin
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Declaration number
EPD-PUE-20130286-CBE1-EN

This Declaration is based on the Product Category Rules:
Insulating materials made of foam plastics, 7-2013
(PCR tested and approved by the independent expert committee)

Issue date
27.02.2014

Valid to
26.02.2019

Owner of the Declaration
PU Europe
Av. E. Van Nieuwenhuyse 6
1160 Brussels (Belgium)

Declared product / Declared unit
1 m² PU thermal insulation board with mineral fleece facing and a thickness of 13.0 cm. The data presented here provide a complete picture of the performance during production, installation and end-of-life.

Scope:
This EPD is a generic association EPD covering PU insulation boards produced by PU Europe members. These members represent 90 % of this market segment and use similar production techniques across Europe. The EPD therefore represents an average of these producers.
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.

Verification
The CEN Norm EN 15804 serves as the core PCR
Independent verification of the declaration and data according to ISO 14025

Prof. Dr.-Ing. Horst J. Bossenmayer
(Managing Director IBU)
Dr. Burkhart Lehmann
(Independent tester appointed by SVA)

Product

Product description
Polyurethane (PU) is a high performance thermal insulation material offering the lowest thermal conductivity of all insulation products commonly available in the market. It offers excellent compressive strength at low densities. PU includes both PUR (polyurethane) and PIR (polysisocyanurate) products.

The product covered by this EPD is a factory-made, closed-cell PU foam board with a flexible mineral fleece facing.

Application
The PU board covered by this EPD is applied for the thermal insulation of residential and commercial buildings according to /EN 13165/ (e.g. interior and exterior insulation for roofs, floors, ceilings and walls).

Technical Data
In this Life Cycle Assessment, a PU insulation board with the following properties has been regarded:

Technical Data

Constructional data

<table>
<thead>
<tr>
<th>Name</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross density</td>
<td>31</td>
<td>kg/m³</td>
</tr>
<tr>
<td>Thermal conductivity</td>
<td>0.026</td>
<td>W/(mK)</td>
</tr>
</tbody>
</table>

Base materials / Ancillary materials
Core material (about 87 % of the weight of the declared unit):
Closed-cell polyurethane foam made from MDI (60.5 %), polyols (29 %), pentane (5 %) and additives (5.5 %).

Facing (about 13 % of the weight of the declared unit):
Mineral fleece mainly consisting of calcium carbonate (84 %), glass fibre (13 %) and urea formaldehyde (3 %).

The PU board for insulation does not contain substances which are included in the "Candidate List of Substances of Very High Concern for Authorisation".

Default values on packaging (use and waste), production waste, air emission and energy used are arithmetic averages of the inputs and outputs per ton produced over one reference year from different PU Europe manufacturers. Since the same machinery and
similar process conditions are applied across Europe, using same base chemicals, they can be considered valid.

Reference service life
The reference service life is 50 years.

LCA: Calculation rules

Declared Unit
The declared unit is 1 m² of PU thermal insulation board with a mineral fleece facing and with the following specifications:

<table>
<thead>
<tr>
<th>Name</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Declared unit</td>
<td>1</td>
<td>m²</td>
</tr>
<tr>
<td>Gross density of the foam</td>
<td>31</td>
<td>kg/m³</td>
</tr>
<tr>
<td>Conversion factor to 1 kg</td>
<td>0.216</td>
<td>m²/kg</td>
</tr>
<tr>
<td>Thickness</td>
<td>13</td>
<td>cm</td>
</tr>
<tr>
<td>Thermal conductivity</td>
<td>0.026</td>
<td>W/mK</td>
</tr>
<tr>
<td>Weight of declared unit</td>
<td>4.63</td>
<td>kg/m²</td>
</tr>
</tbody>
</table>

This provides a thermal resistance R = 5 m² K/W.

The LCI (Life Cycle Inventory) data used in this report is the weighted average of the data supplied by individual members of PU Europe, who manufacture products meeting this specification. The product is manufactured in accordance with /EN 13165/ “Thermal insulation products for buildings – Factory made rigid polyurethane foam (PUR) products – Specification”.

System boundary
This life cycle assessment for the production of the polyurethane insulation board considers the life cycle from the supply of raw materials to the manufacturer’s gate (cradle-to-gate with options). It also includes the transport to the construction site, the installation and the end-of-life stage of the used PU thermal insulation board. The life cycle is split into the following individual phases:

A1 - Raw material formulation (foam materials)
A2 - Raw material transport
A3 - Production of the polyurethane insulation board (energy demands, waste, auxiliaries etc.) and packaging material
A4 - Transport system house to warehouse and from warehouse to the construction site
A5 - Emissions and cutting losses during installation and packaging disposal
C2 - Transport of the used product from the building site to the waste management site
C3/C4 - End-of-Life: waste management (thermal recovery)
D - Benefits and loads beyond system boundary

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.

LCA: Scenarios and additional technical information

Transport to the building site (A4)

<table>
<thead>
<tr>
<th>Name</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Litres of fuel</td>
<td>0.00159</td>
<td>l/100km</td>
</tr>
<tr>
<td>Transport distance</td>
<td>100</td>
<td>km</td>
</tr>
<tr>
<td>Gross density of products transported</td>
<td>31</td>
<td>kg/m³</td>
</tr>
<tr>
<td>Capacity utilization (including empty runs)</td>
<td>85</td>
<td>%</td>
</tr>
</tbody>
</table>

Installation into the building (A5)

<table>
<thead>
<tr>
<th>Name</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material loss</td>
<td>5 %</td>
<td>kg</td>
</tr>
<tr>
<td>Packaging waste</td>
<td>0.35</td>
<td>kg/m²</td>
</tr>
</tbody>
</table>

End of life (C1-C4)

<table>
<thead>
<tr>
<th>Name</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>House</td>
<td>0</td>
<td>kg</td>
</tr>
<tr>
<td>Recycling</td>
<td>0</td>
<td>kg</td>
</tr>
<tr>
<td>Energy recovery</td>
<td>4.23</td>
<td>kg</td>
</tr>
<tr>
<td>Landfilling</td>
<td>0</td>
<td>kg</td>
</tr>
<tr>
<td>Waste processing (C3) Energy for shredding</td>
<td>0.924</td>
<td>MJ</td>
</tr>
</tbody>
</table>

Environmental Product Declaration PU Europe – PU thermal insulation board with mineral fleece facing
## LCA: Results

### Description of the System Boundary

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>A1 - A3</th>
<th>A4</th>
<th>A5</th>
<th>C2</th>
<th>C3</th>
<th>C4</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>GWP</td>
<td>[kg CO₂-eq]</td>
<td>12.9</td>
<td>0.356</td>
<td>0.655</td>
<td>0.067</td>
<td>0.124</td>
<td>9.62</td>
<td>-4.9</td>
</tr>
<tr>
<td>ODP</td>
<td>[kg CFC11-eq]</td>
<td>2.09E-5</td>
<td>6.21E-12</td>
<td>1.18E-11</td>
<td>1.17E-12</td>
<td>1.17E-12</td>
<td>1.01E-10</td>
<td>-1.85E-9</td>
</tr>
<tr>
<td>AP</td>
<td>[kg SO₂-eq]</td>
<td>3.01E-2</td>
<td>2.08E-3</td>
<td>2.48E-4</td>
<td>3.92E-4</td>
<td>5.85E-4</td>
<td>3.96E-3</td>
<td>-1.18E-2</td>
</tr>
<tr>
<td>EP</td>
<td>[kg PO₄²⁻-eq]</td>
<td>4.51E-3</td>
<td>4.91E-4</td>
<td>5.37E-5</td>
<td>9.30E-5</td>
<td>3.08E-5</td>
<td>9.58E-4</td>
<td>-8.34E-4</td>
</tr>
<tr>
<td>POCP</td>
<td>[kg Ethene-eq]</td>
<td>1.42E-2</td>
<td>6.23E-4</td>
<td>1.67E-5</td>
<td>1.56E-4</td>
<td>1.45E-4</td>
<td>2.64E-4</td>
<td>-9.65E-4</td>
</tr>
<tr>
<td>ADPE</td>
<td>[kg Sb-eq]</td>
<td>3.15E-5</td>
<td>1.33E-8</td>
<td>5.97E-9</td>
<td>2.49E-9</td>
<td>1.7E-8</td>
<td>8.4E-8</td>
<td>-3.88E-7</td>
</tr>
<tr>
<td>ADPF</td>
<td>[MJ]</td>
<td>278</td>
<td>4.91</td>
<td>0.222</td>
<td>0.924</td>
<td>1.4</td>
<td>2.52</td>
<td>-9.9</td>
</tr>
</tbody>
</table>

Caption: 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.

### Results of the LCA - Environmental Impact: 1 m² installed PU insulation board – thickness of 13.0 cm

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>A1 - A3</th>
<th>A4</th>
<th>A5</th>
<th>C2</th>
<th>C3</th>
<th>C4</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>PERE</td>
<td>[MJ]</td>
<td>9.89</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>PERM</td>
<td>[MJ]</td>
<td>0</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>PERT</td>
<td>[MJ]</td>
<td>9.89</td>
<td>0.193</td>
<td>0.029</td>
<td>0.036</td>
<td>0.363</td>
<td>0.161</td>
<td>-6.04</td>
</tr>
<tr>
<td>PENRE</td>
<td>[MJ]</td>
<td>195</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>PENRM</td>
<td>[MJ]</td>
<td>101</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>PENRT</td>
<td>[MJ]</td>
<td>296</td>
<td>4.92</td>
<td>0.283</td>
<td>0.927</td>
<td>2.18</td>
<td>2.84</td>
<td>-82.7</td>
</tr>
<tr>
<td>SM</td>
<td>[kg]</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>RSF</td>
<td>[MJ]</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>NRSF</td>
<td>[MJ]</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>FW</td>
<td>[m³]</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Caption: 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 - Resource Use: 1 m² installed PU insulation board – thickness of 13.0 cm

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>A1 - A3</th>
<th>A4</th>
<th>A5</th>
<th>C2</th>
<th>C3</th>
<th>C4</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>HW</td>
<td>[kg]</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>MHW</td>
<td>[kg]</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>RW</td>
<td>[kg]</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CRU</td>
<td>[kg]</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>MFR</td>
<td>[kg]</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>MER</td>
<td>[kg]</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>EEE</td>
<td>[MJ]</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>11.8</td>
</tr>
<tr>
<td>EET</td>
<td>[MJ]</td>
<td>0</td>
<td>0</td>
<td>2.74</td>
<td>0</td>
<td>0</td>
<td>38.1</td>
<td>-</td>
</tr>
</tbody>
</table>

Caption: HW = Hazardous waste disposed; MHW = Non-hazardous waste disposed; RW = 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.

**FW, HW, HW, RW**: Not all of the used inventories for the calculation of the LCA support the methodological approach for the declaration of water and waste indicators. The material amounts, displayed with these inventories contribute to 29% to the production. This is significant, as > 3% (referring to the mass of the declared unit). The indicators are not declared (decision of IBU advisory board 2013-01-07).

**SM**: Only the foreground system is considered.

**MFR**: No credit is given for the amount of recycled steel entering the system without loads.
References

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GaBi 6 2013B
http://documentation.gabi-software.com/
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</tr>
</thead>
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