

Environmental Product Declaration



In accordance with EN 15804 and ISO 14025 for:

Hasopor foam glass 10-60 mm (Cellular glass aggregate)

Hasopor AB

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|--------------------------|---|
| Programme: | The International EPD® System www.environdec.com |
| Programme operator: | EPD International AB |
| EPD registration number: | S-P-01088 |
| Issue date: | 2017-12-14 |
| Validity date: | 2022-12-13 |
| Geographical scope: | Sweden |



Company

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This EPD is a cradle-to-gate analysis, covering stages A1, A2 and A3 according to the EN15804 standard.

Product and Production description

Hasopor foam glass is a lightweight cellular glass aggregate, 10-60 mm, mainly made from recycled glass containers, collected from households in Sweden. After going through the nearby glass sorting facility, the glass is dried and milled to a very fine glass powder. The powder is mixed with an activator and the powder is heated in a kiln at approximately 1000 degrees Celcius and expands 4-5 times. The output from the kiln sets and breaks by cooling, into a granular material of 10-60 mm with a dry bulk density of approximately 180 kg/m³.

Application:

Hasopor foam glass is mainly used as a lightweight filling material, by customers who wish to get environmental and sustainable benefits. The most common use cases are groundwork for road, house and geotechnical construction areas.

Service life:

Limited by the service life of the construction, where the product is used. Product does not degrade over time. It is possible to extract the product after construction service life time and reuse it in another construction, similar to stone aggregate, which would extend the life time even further.

Content declaration:

| Materials | Share of product, [%] | Amount, recycled material [%] | Additional information |
|---|-----------------------|-------------------------------|------------------------|
| Glass, waste fraction from recycling | > 97 % | 100 % | Non hazardous |
| Silicon carbide, secondary flow from Silicon industry | < 3 % | - | Non hazardous |

Materials on the "Candidate List of substances of very high concern for Authorisation": None

All recycled material is collected post-consumer.

LCA model

General info:

| | |
|---------------------------------------|---|
| DECLARED UNIT | 1m ³ of Hasopor cellular glass aggregate ready for bulk transport to customer |
| SYSTEM BOUNDARIES | Cradle to gate: Mandatory stages A1 – A3 |
| REFERENCE SERVICE LIFE (RSL) | N/A |
| CUT-OFF RULES | Life Cycle Inventory data for a minimum of 99% of total inflows to the upstream and core module has been included. Processes that don't lead to a measurable physical or energy in- or outflow, such as company travel or services supplied by external partners, have not been included. |
| ALLOCATIONS | Economic allocation has been used in calculation of impact from silicon carbide production, due to use of low value, secondary production/waste flow (powder form). Effects of primary production of recycled materials, including waste handling, allocated to the main product in which the material was used, in accordance with EN 15804. The recycling process and transportation of the material is allocated to this analysis. |
| GEOGRAPHICAL COVERAGE AND TIME PERIOD | Sweden, primary data from 2016 |

According to EN 15804, EPD's of construction products may not be comparable if they do not comply with this standard. According to ISO 21930, EPD's might not be comparable if they are from different programmes. The scenarios included are currently in use and are representative for one of the most likely scenario alternatives. All primary product data was provided by Hasopor AB. All secondary data was retrieved using the GaBi software, version 7.3, with Ecoinvent 3.2 (2017) and GaBi Professional (2017) databases.

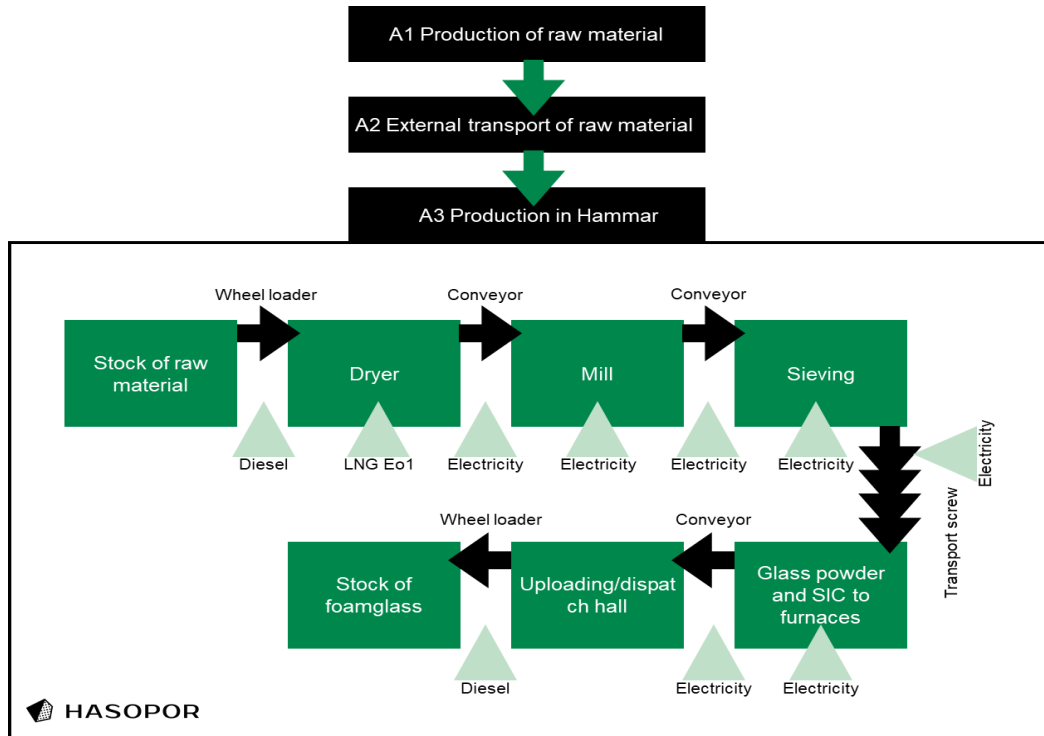
Data quality:

| Raw material | Data quality | Data Source and description | Age of data |
|---|--------------|---|-------------|
| Glass | - | Waste fraction from glass recycling. Impacts from glass collection and sorting are allocated to production of the original glass product. | - |
| Silicon carbide | Data base | Ecoinvent 3.3. Altered for Norwegian production conditions | 2015 |
| Energy in HASOPOR production | | | |
| Use | Specific | HASOPOR | 2016 |
| Extraction and distribution, electricity | Generic data | GaBi Professional 2017. Electricity 100% hydro power | 2013 |
| Extraction and distribution, fossil fuels | Generic data | GaBi Professional 2017. | 2013 |
| Transport | | | |
| Distances | Specific | HASOPOR | 2016 |
| Extraction, infrastructure and combustion | Generic data | GaBi Professional 2017 | 2013 - 2016 |

The electricity used in the production is supplied by Mälarenergi and is 100% hydro power.

No specific assumptions have been made.

Flow diagram:



EN15804 break-down of life-cycle stages

| Product stage | | | Construction process stage | | Use stage | | | | | | | End of life stage | | | | Resource recovery stage |
|---------------|-----------|---------------|----------------------------|---------------------------|-----------|-------------|--------|-------------|---------------|------------------------|-----------------------|----------------------------|-----------|------------------|----------|------------------------------------|
| Raw materials | Transport | Manufacturing | Transport | Construction installation | 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 | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND |

X = Included, MND = Module Not Declared.

Description of the stages: A1-A3

A1, raw material extraction and processing, processing of secondary material input (e.g. recycling processes). This includes the extraction and processing of all raw materials and energy which occur upstream from the manufacturing process.

There are two basic raw materials: recycled bottle glass and fine grain silicon carbide. The glass originates mainly from a glass recycling site co-located with the Hasopor production, at Hammar Sweden. A smaller part of the glass raw material originates from glass recycling sites in England and Poland. The silicon carbide originates from a producer of high quality silicon carbide in Norway, and the fine grain quality that is used for Hasopor is a bi-product of their silicon carbide production process.

A2, transport to the manufacturer. The raw materials are transported to the manufacturing site. The modelling includes road, boat and/or train transportations of each raw material. However most comes

via conveyors or wheel loaders very close to the production and therefore their impact are included in A3.

The glass raw material from the co-located recycling plant in Hammar is transported using Hasopors own wheel loaders, and conveyor belts. The glass raw material from England and Poland is transported using trucks, and ferries. The silicon carbide raw material is transported using trucks. All truck and ferry transports are made in bulk.

A3, manufacturing, including provision of all materials, products and energy, as well as waste processing up to the end-of waste state or disposal of final residues during the product stage. This module includes the manufacture of products and the manufacture of packaging. The production of packaging material is taken into account at this stage. The processing of any waste arising from this stage is also included.

See the flow diagram for a detailed description of the production process.

Environmental performance

Results per declared unit (1 m³ of HASOPOR cellular glass aggregate at factory gate, ready for bulk transport to customer).

Use of resources

| | UNIT | A1 | A2 | A3 | A1+A2+A3 |
|--|-------------------------|--------|---------|-------|----------|
| Use of renewable primary energy excluding renewable primary energy resources used as raw materials | MJ, net calorific value | 22,8 | 0,444 | 518 | 541 |
| Use of renewable primary energy resources used as raw materials | MJ, net calorific value | - | - | - | - |
| Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials) | MJ, net calorific value | 22,8 | 0,444 | 518 | 541 |
| Use of non- renewable primary energy excluding non- renewable primary energy resources used as raw materials | MJ, net calorific value | 8,44 | 11,3 | 61,6 | 81,3 |
| Use of non- renewable primary energy resources used as raw materials | MJ, net calorific value | - | - | - | - |
| Total use of non- renewable primary energy resources (primary energy and primary energy resources used as raw materials) | MJ, net calorific value | 8,44 | 11,3 | 61,6 | 81,3 |
| Use of secondary material | kg | 0 | 0 | 153 | 153 |
| Use of renewable secondary fuels | MJ, net calorific value | - | - | - | - |
| Use of non-renewable secondary fuels | MJ, net calorific value | - | - | - | - |
| Use of net fresh water | m ³ | 0,0383 | 0,00994 | 1,35* | 1,4 |

* >95% of water use is from evaporation at hydropower plant where the electricity is generated.

Potential environmental impact

| | UNIT | A1 | A2 | A3 | A1+A2+A3 |
|--|--------------------------------------|----------|----------|----------|----------|
| Global warming potential (GWP ₁₀₀) | kg CO ₂ -eq | 1,46 | 0,844 | 5,47 | 7,77 |
| Ozone depletion potential | kg CFC11-eq | 7,23E-08 | 2,67E-13 | 1,58E-12 | 7,23E-08 |
| Acidification potential | kg SO ₂ -eq | 0,00700 | 0,00775 | 0,00576 | 0,0205 |
| Eutrophication potential | kg PO ₄ ³⁻ -eq | 0,000462 | 0,000988 | 0,00121 | 0,00266 |

| | | | | | |
|---|--------------------------------------|----------|-----------|-----------|-----------|
| Photochemical oxidant creation potential | kg C ₂ H ₄ -eq | 0,000477 | -0,000108 | 0,000464 | 0,000833 |
| Depletion of abiotic resources (elements) | kg Sb-eq | 1,44E-06 | 5,68E-08 | 0,0000155 | 0,0000170 |
| Depletion of abiotic resources (fossil) | MJ net calorific value | 7,28 | 11,3 | 61,3 | 79,9 |

Impact methods used: CML 2001 – Jan. 2016.

Waste production

| | UNIT | A1 | A2 | A3 | A1+A2+A3 |
|---------------------|------|----------|-----------|-----------|----------|
| Non-hazardous waste | kg | 0,00975 | 0,000680 | 0,948 | 0,958 |
| Hazardous waste | kg | 9,47E-09 | 4,57E-07 | 5,58E-07* | 1,02E-06 |
| Radioactive waste | kg | 0,000456 | 0,0000151 | 0,000120* | 0,000591 |

* 100% of Hazardous and Radioactive waste originates from production of energy and fuels used.

Other environmental information

- Product does not degrade with time. It is possible to extract the product after construction service life time and reuse it directly in another construction. Depending on the demands of the second construction there might be need to wash the product before reuse, similar to stone aggregate.
- For further information about certificates and product features see our website www.hasopor.se

Programme-related information and verification

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|-------------------------------|--|
| Programme: | The International EPD® System EPD International AB Box 210 60 SE-100 31 Stockholm Sweden www.environdec.com |
| Product Category Rules: | PCR 2012:01 Construction Products and Construction Services. Version 2.2 |
| Product group classification: | UN CPC 371 |
| Reference year for data: | 2016 |
| Geographical scope: | Sweden |

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|---|
| Product category rules (PCR): <i>CONSTRUCTION PRODUCTS AND CONSTRUCTION SERVICES, 2012:01, version 2.2</i> |
| PCR review was conducted by: <i>The Technical Committee of the International EPD® System. Chair: Massimo Marino. Contact via info@environdec.com</i> |
| Independent verification of the declaration and data, according to ISO 14025:2006: <input type="checkbox"/> EPD Process Certification (internal) <input checked="" type="checkbox"/> EPD Verification (external) |
| Third party verifier: <i>Carl-Otto Nevén</i> Accredited by: <i>Approved by the International EPD System</i> |

Mandatory statements

- This is a cradle-to-gate (A1-A3) EPD according to the EN 15804 PCR,
- EPD of construction products may not be comparable if they do not comply with EN 15804.

“EPDs within the same product category but from different programmes may not be comparable”

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| Programme operator: |  EPD International AB Box 210 60, SE-100 31 Stockholm www.environdec.com info@environdec.com |

References

General Programme Instructions of the International EPD® System. Version 2.01.

PCR 2012:0. CONSTRUCTION PRODUCTS AND CONSTRUCTION SERVICES. Version 2.2

LCA-report Hasopor foam glass 10-60 mm (Cellular glass aggregate). *Jonatan Wranne, IVL Swedish Environmental Research Institute*

Certificate hydro power. *Mälarenergi, provided by Axel Ekström, Miljöbyrån, on assignment by Hasopor AB*

Information about value and production of small grain silicon carbide *Personal communication, silicon carbide producer, Norway, through Axel Ekström, Miljöbyrån, on assignment by Hasopor AB*

Information about inputs and outputs of Hasopor AB. *Personal communication. Axel Ekström, Miljöbyrån, on assignment by Hasopor AB, and Roger Borén, Hasopor AB*

Modelling software: GaBi ts, version 7.3

Databases: Ecolnvent 3.3 and GaBi Professional 2017