ENVIRONMENTAL PRODUCT DECLARATION

THE INTERNATIONAL EPD® SYSTEM

Institut Bauen und Umwelt e.V.

According to ISO 14025 and EN 15804

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The International EPD® System and Institut Bauen und Umwelt e.V (IBU)

Program operator: Institut Bauen und Umwelt e.V.
Publisher: International EPD® System
Declaration number: EPD-HHI-20140046-IAA1-EN
EPD-HHI-20140047-IAA1-EN
Registration number: S-P-00595
Issue date: 2014-05-16
Valid to: 2020-05-15

Non-reinforced AAC
H+H Deutschland GmbH

1. General information

H+H Deutschland GmbH	Non-reinforced autoclaved aerated concrete (AAC)
Programme holder IBU – Institut Bauen und Umwelt e.V. Panoramastr. 1 10178 Berlin Germany	**Holder of the Declaration** H+H Deutschland GmbH Industriestr. 3 23829 Wittenborn
Declaration number EPD-HHI-20140046-IAA1-EN EPD-HHI-20140047-IAA1-EN	**Declared product/unit** 1m³ AAC 2-0.35 and 1m³ AAC 8-0.80 (Note: Different product descriptions are used in Germany: P2 0,40 corresponds to AAC 2-0.35 and P8 0,80 to AAC 8-0.80)
This Declaration is based on the Product Category Rules: Aerated concrete, 08-2012 (PCR tested and approved by the independent Expert Committee (SVA)) **Issue date** 16.05.2014 **Valid until** 15.05.2020	**Area of applicability:** The environmental indicators for non-reinforced autoclaved aerated concrete (AAC) are depicted in the Environmental Product Declaration. This document refers to the manufacture of AAC 2-0.35 and AAC 8-0.80 products, whereby the AAC 2-0.35 product represents the product displaying the lowest gross density class within the product portfolio offered by H+H Deutschland GmbH and AAC 8-0.80 represents the product displaying the highest gross density class. Product data for 2012 was collated in the three H+H Deutschland GmbH plants: Wittenborn I, Wittenborn II and Hamm. The respective results for AAC 2-0.35 and AAC 8-0.80 serve as maximum and minimum limits for all other products offered by H+H Deutschland GmbH. The environmental impacts established here represent a *worst-case scenario* for AAC 8-0.80. Based on plausible, transparent and comprehensible basic data, the Life Cycle Assessment fully represents the products in question. The holder of the Declaration is liable for the information and evidence on which it is based; liability by IBU concerning manufacturer's information, LCA data and evidence is excluded.
Prof. Dr.-Ing. Horst J. Bossenmayer (President of Institut Bauen und Umwelt e.V.)	**Verification** The DIN EN 15804 CEN standard serves as the core PCR. Verification of the EPD by an independent third party in accordance with ISO 14025 ☐ internally ☒ externally
Dr.-Ing. Burkhart Lehmann (Managing Director IBU)	Patricia Wolf, (Independent verifier appointed by the SVA)

2. Product

2.1 Product description

The products referred to are components and building elements in various formats made of autoclaved aerated concrete (AAC).
AAC is classified as a porous, steam-cured, lightweight concrete.
AAC products can be manufactured to various raw densities but are produced using the same manufacturing technology. When comparing products of various compressive strength classes, formulation differences are apparent, whereby the preliminary products used are always identical.
The AAC 2-0.35 product selected for the Declaration represents the product in the lowest raw density class while the AAC 8-0.80 product represents the highest gross density class among the AAC masonry units manufactured by H+H Deutschland GmbH. An average for the AAC 2-0.35 product is formed by weighting in accordance with the annual production volume at the three locations. The AAC 8-0.80 product is only produced at one location (Wittenborn I).

2.2 Application

Precision blocks, precision elements and precision panels for masonry, load-bearing and non-bearing walls
Not designated for unprotected use

2.3 Technical data

Sound insulation to EN DIN 4109-32:
a) In the range 50 kg/m² ≤ m‘ < 150 kg/m², the following applies:
Rw = 32.6 log (m’total/m‘0) – 22.5 in decibel (dB) with reference size m‘0 = 1 kg/m²
b) In the range 150 kg/m² ≤ m‘ < 300 kg/m², the following applies:
Rw = 26.1 log (m’total/m‘0) – 8.4 in decibel (dB) with reference size m‘0 = 1 kg/m²

Fire protection:
Non-combustible Euro-class A1 in accordance with DIN EN 13501-1
In accordance with DIN 4102-4: Depending on fire exposure and wall configuration (?)
Fire resistance classes F 30 – A to F 180 – A through to fire-resisting wall

Construction data (declared in accordance with EN771-4)

Description	Value	Unit
Compressive strength	2 – 10	N/mm^2
Raw density	0.3 - 0.8	t/m^3
Tensile strength	0.24 - 1.2	N/mm^2
Elastic modulus	750 – 3250	N/mm^2
Thermal conductivity	0.08 - 0.21	W/(mK)
Water vapour diffusion resistance factor to DIN 4108-4	5 – 10	-
Equilibrium moisture at 23 °C, 80%	< 4	% by mass
Shrinkage to EN 680 (reference)	< 0.2	mm/m

Bending tensile strength is not of relevance for designing AAC walls; values therefore are not required in any of the corresponding rules.

2.4 Placing on the market / Application rules

Regulation (EU) No. 305/2011 dated 9 March 2011 applies for placing on the market within the European Union/EFTA. The products require a Declaration of Performance taking consideration of EN 771-4:2011-07 – Specification for masonry units – Part 4: Autoclaved aerated concrete masonry units and CE marking.

Use is governed by the respective national provisions; in Germany: the DIN V 20000-404:2006-01: Application of building products in structures – Part 404: Rules for the application of autoclaved aerated concrete masonry units according to DIN EN 771-4:2005-05 as well as the relevant general building inspectorate approvals of the DIBt, Berlin and DIN 1053, DIN 1996 (EC 6).

Other applicable standards:
DIN V 4165-100:2005-10: Autoclaved aerated concrete masonry units - Part 100: High-precision units and elements with specific properties

DIN 4166:1997-10: Autoclaved aerated concrete slabs and panels

2.5 Delivery status

DIN 1053, DIN 1996 (EC 6)

2.6 Base materials / Auxiliaries

Description	Value	Unit
Sand	40-72	%
Cement	9-45	%
Caustic lime	10-20	%
Anhydrite / Gypsum	2-5	%
Aluminium	0.01-0.4	%

Water is added and accounts for approx. 50-75% of total solids used.
Mould oil is used as an auxiliary.

No substances of REACH relevance according to the list of candidates dated 21.06.2013 are used in production.

Sand:
The sand used is a natural raw material which contains quartz (SiO_2) as a primary mineral as well as natural minor and trace minerals. It is an essential base material for the hydrothermal reaction during steam curing.
Cement:
In accordance with DIN EN 197-1, cement serves as a binding agent and is largely manufactured from lime marl or a mixture of lime and clay. These natural raw materials are burned before being ground.
Caustic lime:
In accordance with DIN EN 459, caustic lime serves as a binding agent and is manufactured by burning natural lime.
Gypsum:
As per DIN 1169, sulphate agent serves towards influencing the curing time for AAC and originates from natural reserves or is produced technically.
Aluminium:
Aluminium powder or paste serves as a pore-forming agent.
Water:
Water is a medium and reaction partner for the hydraulic and hydrothermal reaction of the binding agents. Water is also required for manufacturing a homogeneous suspension.
Mould oil:
Mould oil is used as a release agent between the mould and the raw AAC mixture. Mineral or vegetable oils are used which are free of polycyclic aromatic hydrocarbons and by adding long-chain additives to increase viscosity.

2.7 Production

The ground quartz sand is mixed with lime, cement and crushed recycled AAC material, adding water and aluminium powder or paste, in a mixer to form an aqueous suspension and cast in moulds. The water quenches the lime under heat generation. The aluminium reacts with the existing water in the alkaline environment. The hydrogen released during this process creates the pores in the gross mass. After the rising and blowing process, the hydrogen evaporates and air remains in the pores. The pores are 0.5 to 1.5 mm in diameter. The initial binding process results in semi-solid ingots from which the various AAC component formats are cut precisely using taut wires. The final AAC characteristics arise during the subsequent steam curing process over 5 to 12 hours at approx. 190 °C and pressure of approx. 12 bar in steam pressure chambers, so-called autoclaves, where the substances used form calcium silicate hydrates which correspond to the tobermorite mineral prevailing in nature. The material reaction is concluded on removal from the autoclave. The steam is transferred to other autoclave cycles once the curing process is finished. The condensate incurred is used as process water. This saves energy and avoids pollution by hot steam and waste water. AAC components are then stacked on wooden pallets and shrink-wrapped in recyclable polyethylene (PE) foil.

2.8 Environment and health during production
The applicable regulations of the professional liability associations apply; no special measures are required to be taken to protect employee health.

2.9 Product processing / Installation
AAC masonry units are processed by hand; lifting equipment is required for components whose mass exceeds 25 kg. Components are cut using band saws or by hand-held carbide saws which only generate coarse dust and no fine dust. High-speed tools such as angle grinders are not suitable for processing AAC as they release fine dust. Masonry comprising AAC precision blocks, precision elements and precision panels is carried out with thin-bed mortar in accordance with DIN 1053-1 (11 kg mortar/m³). The AAC components can be plastered, coated or painted. Curtain façades or fair-face cavity brickwork as per DIN 1053-1 are also possible. The professional liability associations' rules apply. No special environmental protection measures need to be taken while processing the building products.

2.10 Packaging
Empty packaging and pallets on the building site must be collected separately. Polyethylene shrink-wrap foil and mortar sacks are directed to a regulated recycling system. The reusable wooden pallets are returned to the construction trade within the framework of the deposit system from where they are returned to the AAC concrete plants.

2.11 Condition of use
As outlined under 2.7 "Production", AAC primarily comprises tobermorite, a natural mineral. Accordingly, no emissions are incurred during use.

2.12 Environment and health during use
AAC does not emit any hazardous substances such as volatile organic compounds (VOC). The naturally ionising radiation of AAC products is extremely low permitting unlimited use of this material from a radiological perspective (see 7.1 Radioactivity).

2.13 Reference Service Life
AAC does not alter its appearance after leaving the autoclave. It exhibits unlimited resistance properties when used as designated. There are no verifiable influences on ageing when the normal recognised rules of technology are applied.
The reference service life of protected AAC is 80 to 150 years.

2.14 Extraordinary effects

Fire

Fire protection

Description	Value
Building material class	A1

In case of a fire, no toxic gases and vapours can arise.

Water

When exposed to water (e.g. flooding), AAC reacts slightly alkaline. No substances are washed out which could be hazardous to water.

Mechanical destruction

No destruction occurs when the technical structural rules and building guidelines are adhered to.

2.15 Re-use phase
Sorted residual AAC can be taken back by the AAC manufacturers and re-used or recycled. This practice has been applied with broken product for decades. This material is either processed as granulate products or added to the AAC mixture as a substitute for sand.

2.16 Disposal
In accordance with the German Landfill Ordinance of 27.04.2009, AAC must be disposed of in Class I landfills (see 7.2 Leaching). Waste key number in accordance with the European Waste Catalogue: 17 01 01

2.17 Further information
Additional information available online at www.hplush.de.

3. LCA: Calculation rules

3.1 Declared unit
This Declaration refers to the production of 1m³ AAC 2-0.35 with an average gross density of 375 kg/m³ and the production of 1m³ AAC 8-0.80 with an average gross density of 884 kg/m³. Both products represent non-reinforced AAC.

Declared unit AAC 2-0.35

Description	Value	Unit
Declared unit	1	m^3
raw density	375	kg/m^3
Conversion factor to 1 kg	1/375-	-

Declared unit AAC 8-0.80

Description	Value	Unit
Declared unit	1	m^3
raw density	884	kg/m^3
Conversion factor to 1 kg	1/884	-

3.2 System boundary
Type of EPD: cradle to plant gate
The following individual processes were included in the Product stage A1-A3 of manufacturing the AAC products:

- Processes associated with supplying ancillaries and energy
- Transporting the resources, preliminary products (cement, lime, sand etc.) and ancillaries to the respective production site
- Manufacturing process in the plant including energy, manufacturing ancillaries, disposing of any residual materials incurred

- Manufacturing the packaging

3.3 Estimates and assumptions

Aluminium powder is used in the Hamm plant for which no information is available regarding the transport distance to the plant. The percentage by mass of aluminium powder in the AAC 2-0.35 product is < 0.1%. The distance was estimated as 690 km. The transport distance was also estimated for the anhydrite (<< 1% by mass) used in Wittenborn II. The influences on the results of the AAC 2-0.35 product are negligible. The AAC 8-0.80product is not produced in Hamm or Wittenborn II; accordingly, the results remain unaffected by these assumptions.

The anhydrite used involves REA anhydrite. When forming the LCA model, estimates are made using the DE: Anhydrite data set which represents a mix of 3 different manufacturing routes (natural, thermal, synthetic). The influence on results is less than 1%. Mere use of REA anhydrite would be interesting for the ADPe impact category in particular as it would "save" on natural gypsum reserves. But the environmental impacts in the ADPe are almost entirely dominated by the upstream chains associated with cement production.

In Wittenborn I and Wittenborn II, no reliable details can be provided in terms of internal diesel consumption. After consultation with H+H Deutschland GmbH however, the values in the Hamm plant (in litres/m³) can also be regarded as representative for Wittenborn and used accordingly. The influence on results is less than 1%.

3.4 Cut-off criteria

All operating data, i.e. all of the starting materials used, thermal energy, internal fuel consumption and electricity consumption, all direct production waste as well as all emission measurements available were taken into consideration in the analysis. Where no primary data was available, assumptions were made as regards the transport distances associated with all input and output data taken into consideration. Accordingly, material and energy flows with a share of less than 1 per cent were also considered. It can be assumed that the total of all neglected processes does not exceed 5 % in the effective categories. Machinery, plants and infrastructure required in the manufacturing process are ignored.

3.5 Background data

The software system for comprehensive analysis (GaBi 6) developed by PE INTERNATIONAL AG was used for modelling the AAC production process. The consistent data items contained in the GaBi data base are documented in the online GaBi documentation. The basic data in the GaBi data base was applied for energy, transport and consumables. The Life Cycle Assessment was drawn up for Germany as a reference area. This means that apart from the production processes under these marginal conditions, the pre-stages also of relevance for Germany such as provision of electricity or energy carriers were used. The power mix for Germany 2010 is applied.

3.6 Data quality

All of the background data records of relevance for manufacturing were taken from the GaBi 6 software data base. Primary data was supplied by H+H Deutschland GmbH.
The background data used was last revised less than 1 year ago. The production data involves up-to-date industrial data on H+H Deutschland GmbH from 2012.

3.7 Period under review

The data applied for this LCA is based on data recorded for the manufacture of AAC products in 2012. The volumes of raw materials, energy, ancillaries and consumables used are considered as average annual values in the Wittenborn I, Wittenborn II and Hamm plants.

3.8 Allocation

Granulate products are incurred as by-products during the AAC production process. They are sold by H+H Deutschland GmbH to external customers as cat litter or oil-binding agents. Any additional processing of this by-product - such as grinding and packaging - can not be quantified separately but is included in the primary data collated (primarily in electricity requirements) on AAC production.

A more detailed examination of the by-product indicates that its contribution towards operating income is < 1%: according to EN 15804, processes making a very minor contribution towards operating income (<1%) can be ignored. Nevertheless, an economic allocation is undertaken in this case.

Furthermore, broken AAC is incurred during the production process which is re-used directly in production in the form of crushed recycled aerated concrete material. These flows are modelled in a closed loop.

3.9 Comparability

As a general rule, a comparison or evaluation of EPD data is only possible when all of the data sets to be compared have been drawn up in accordance with EN 15804 and the building context and/or product-specific performance characteristics are taken into consideration.

4. LCA: Scenarios and additional technical information

Reference Service Life

Description	Value	Unit
Reference Service Life	80 - 150	a

5. LCA: Results

The environmental impacts of 1m³ non-reinforced AAC 2-0.35 manufactured by H+H Deutschland GmbH are depicted below. The modules marked "x" as per EN 15804 in the overview are addressed; the modules marked "MND" (Module not declared) do not form a component of the analysis.
The following tables depict the results of the indicators concerning impact estimates, use of resources as well as the waste and other output flows with reference to the declared unit.

SYSTEM BOUNDARIES (X = INCLUDED IN THE LCA; MND = MODULE NOT DECLARED)

Product stage			Construction process stage		Use stage							Disposal stage				Benefits and loads beyond the system boundaries
Provision of raw materials	Transport	Production	Transport from manufacturer to site	Assembly	Use / Application	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction	Transport	Waste treatment	Landfilling	Re-use, recovery or 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

LCA RESULTS – ENVIRONMENTAL IMPACT: 1m³ AAC 2-0.35

Parameter	Unit	A1 - A3
Global Warming Potential	[kg CO_2 equiv.]	180
Ozone Depletion Potential	[kg CFC11 equiv.]	2.55E-09
Acidification Potential of soil and water	[kg SO_2 equiv.]	2.17E-01
Eutrification Potential	[kg $(PO_4)^{3-}$ equiv.]	2.80E-02
Photochemical Ozone Creation Potential	[kg ethene equiv.]	1.96E-02
Abiotic Depletion Potential non-Fossil Resources	[kg Sb equiv.]	2.00E-04
Abiotic Depletion Potential Fossil Resources	[MJ]	981

LCA RESULTS – USE OF RESOURCES: 1m³ AAC 2-0.35

Parameter	Unit	A1 - A3
Renewable primary energy as energy carrier	[MJ]	171
Renewable primary energy as material utilisation	[MJ]	0
Total use of renewable primary energy sources	[MJ]	171
Non-renewable primary energy as energy carrier	[MJ]	1091
Non-renewable primary energy as material utilisation	[MJ]	0
Total use of non-renewable primary energy sources	[MJ]	1091
Use of secondary materials	[kg]	0
Renewable secondary fuels	[MJ]	37.2
Non-renewable secondary fuels	[MJ]	392
Net use of fresh water	[m³]	0.46

LCA RESULTS – OUTPUT FLOWS AND WASTE CATEGORIES: 1m³ AAC 2-0.35

Parameter	Unit	A1 - A3
Hazardous waste for disposal	[kg]	0.11
Disposed of, non-hazardous waste	[kg]	8.5
Disposed of, radioactive waste	[kg]	0.04
Components for re-use	[kg]	-
Materials for recycling	[kg]	-
Materials for energy recovery	[kg]	-
Exported electrical energy	[MJ]	-
Exported thermal energy	[MJ]	-

The results of the impact estimates only represent relative statements. They do not make any claims concerning impact category limits, exceeding threshold values, safety limits or risks.

The environmental impacts of 1m³ non-reinforced AAC 8-0.80 manufactured by H+H Deutschland GmbH are depicted below. The modules marked "x" as per EN 15804 in the overview are addressed; the modules marked "MND" (Module not declared) do not form a component of the analysis.
The following tables depict the results of the indicators concerning impact estimates, use of resources as well as the waste and other output flows with reference to the declared unit.

SYSTEM BOUNDARIES (X = INCLUDED IN THE LCA; MND = MODULE NOT DECLARED)

Product stage			Construction process stage		Use stage							Disposal stage				Benefits and loads beyond the system boundaries
Provision of raw materials	Transport	Production	Transport from manufacturer to site	Assembly	Use / Application	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction	Transport	Waste treatment	Landfilling	Re-use, recovery or 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

LCA RESULTS – ENVIRONMENTAL IMPACT: 1m³ AAC 8-0.80

Parameter	Unit	A1 - A3
Global Warming Potential	[kg CO_2 equiv.]	303
Ozone Depletion Potential	[kg CFC11 equiv.]	2.84E-09
Acidification Potential of soil and water	[kg SO_2 equiv.]	2.49E-01
Eutrification Potential	[kg $(PO_4)^{3-}$ equiv.]	3.64E-02
Photochemical Ozone Creation Potential	[kg ethene equiv.]	2.20E-02
Abiotic Depletion Potential non-Fossil Resources	[kg Sb equiv.]	2.14E-04
Abiotic Depletion Potential Fossil Resources	[MJ]	1516

LCA RESULTS – USE OF RESOURCES: 1m³ AAC 8-0.80

Parameter	Unit	A1 - A3
Renewable primary energy as energy carrier	[MJ]	186
Renewable primary energy as material utilisation	[MJ]	0
Total use of renewable primary energy sources	[MJ]	186
Non-renewable primary energy as energy carrier	[MJ]	1665
Non-renewable primary energy as material utilisation	[MJ]	0
Total use of non-renewable primary energy sources	[MJ]	1665
Use of secondary materials	[kg]	0
Renewable secondary fuels	[MJ]	39.8
Non-renewable secondary fuels	[MJ]	419
Net use of fresh water	[m³]	0.79

LCA RESULTS – OUTPUT FLOWS AND WASTE CATEGORIES: 1m³ AAC 8-0.80

Parameter	Unit	A1 - A3
Hazardous waste for disposal	[kg]	0.15
Disposed of, non-hazardous waste	[kg]	23.9
Disposed of, radioactive waste	[kg]	0.06
Components for re-use	[kg]	-
Materials for recycling	[kg]	-
Materials for energy recovery	[kg]	-
Exported electrical energy	[MJ]	-
Exported thermal energy	[MJ]	-

The results of the impact estimates only represent relative statements. They do not make any claims concerning impact category limits, exceeding threshold values, safety limits or risks.

6. LCA: Interpretation

The results presented for the AAC 2-0.35 and AAC 8-0.80products each indicate the maximum and minimum environmental performance by AAC products manufactured by H+H Deutschland GmbH.

The manufacture of 1m³ aerated concrete requires between 1100 and 1700 MJ non-renewable primary energy. Additionally, 170 to 190 MJ/m³ renewable primary energy are also used.

The Global Warming Potential of AACproduction amounts to 180 to 300 kg CO_2 equivalent per cubic metre ofAAC.

The environmental performance of AACproduction is primarily determined by the use of binding agents. The lime and cement production upstream chains have a significant influence on the results in almost all of the evaluation indicators reviewed. PENRT, EP and AP are approx. 60-70% dominated by the production of binding agents while this figure increases to 80-90% for the GWP and POCP.

One exception is presented by the use of renewable primary energy. Renewable primary energy is required as a result of the use of wooden pallets as packaging material. Another percentage is attributable to the regenerative share in the power mix. Electricity is required in the plant and during the upstream chains associated with the provision of raw materials and manufacturing preliminary products.

During the direct product manufacturing process, no external secondary materials or secondary fuels are used. The declared secondary fuels are entirely attributable to the upstream chains associated with cement production. During the burning process for cement clinker, the cement industry burns a wide variety of secondary fuels.

During the production (Modules A1–A3) of 1m³ AAC0.5 to 0.8 m³ water are required, including for the upstream chains. Water is used directly in the manufacture of AAC, as process water and as mixing water for the recipe.

An analysis of waste volumes is depicted separately for three main segments: disposed of non-hazardous waste for landfilling, hazardous waste for landfilling and disposed of radioactive waste. Non-hazardous waste represents the largest percentage during manufacturing. Non-hazardous waste is incurred as a result of the extraction and processing of sand. Hazardous waste is primarily incurred during the upstream chains associated with energy production. Radioactive waste is exclusively incurred in generating electricity in nuclear power plants. The German power mix displays a nuclear energy share of 22%.

When comparing the results for AAC 2-0.35 and AAC 8-0.80, it is obvious that there is no simple correlation. This is attributable to the various formulations. For example, the GWP of 1m³ AAC 8-0.8 compared to the GWP of 1m³ AAC 2-0.35 "only" 1.7 times higher despite the weight per m³ being 2.4 times higher. When comparing the results of non-renewable primary energy requirements, a factor of 1.5 is obtained.

There is therefore no direct correlation between the gross density and environmental pollution on account of the differences in composition. Although the AAC 2-0.35 product displays a higher percentage of binding agent content, the absolute content of cement and lime in [kg/m³] is the highest for the AAC 8-0.80 product. As the environmental impacts are particularly dependent on these two recipe components, the Declaration of the AAC 8-0.80 product depicts a *worst-case scenario*.

Data quality

All in all, the quality of data can be regarded as good for modelling the H+H Deutschland GmbH AAC products. Corresponding consistent data records were available in the GaBi data base for the preliminary products and auxiliaries used. The data used was last revised less than 1 year ago.

The production data involves up-to-date primary data on all H+H Deutschland GmbH plants in 2012. The volumes of raw materials, energy, auxiliaries and consumables used are considered as average annual values.

In the LCA model, assumptions are made as regards the transport distance for anhydrite and aluminium powder. The influences on the results of the AAC 2-0.35 product are negligible as the results of the AAC 8-0.80product are not affected by these assumptions. Furthermore, diesel requirements for Wittenborn are estimated along with H+H Deutschland GmbH on the basis of data for the Hamm plant. The influence on results is less than 1%. The assumptions made do not enable any restrictions to be derived with regard to how the results are interpreted in the EPD.

7. Requisite evidence

7.1 Radioactivity

Measuring agency: LGA Bautechnik GmbH Strahlenschutz, Tillystrasse 2, 90431 Nuremberg
Method: Measurement of the nuclide content in Bq/kg, determining the Activity Index I
Result: Measurement report M060534/2 A+B, July 2006
The samples were evaluated in accordance with the European Commission Guideline "Radiation Protection 112" (Radiological Protection Principles concerning the Natural Radioactivity of Building Materials, 1999). The Activity Index I comprises 0.19 for the Wittenborn plant and 0.11 for the Hamm plant with the result that it falls short of the recommended limit values.

8. References

Institut Bauen und Umwelt e.V., Berlin (pub.):

General Principles for the EPD range of Institut Bauen und Umwelt e.V. (IBU), 2013-04

Product Category Rules for Building Products, Part A: Calculation rules for the Life Cycle Assessment and requirements on the background report, 2013-04

DIN EN ISO 14025:2011-10, Environmental labels and declarations – Type II environmental declarations – Principles and procedures

EN 15804:2012-04+ A1 2013, Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products

PCR 2013, Part B
Institut Bauen und Umwelt e.V., Berlin (pub.): Product Category Rules for building products from the range of Environmental Product Declarations of Institut Bauen und Umwelt (IBU), Part B: Requirements on the EPD for aerated concrete, version 1.5 of 2013-10, www.bau-umwelt.de

REACH candidate list
REACH – Regulation concerning the Registration, Evaluation, Authorisation and Restriction of CHemicals, Candidate List of Substances of Very High Concern for Authorisation, http://echa.europa.eu/web/guest/candidate-list-table, 06-2013

DIN 4102-4
DIN 4102-4:1994-03: Fire performance of building materials and components; A1: Composition and application of classified construction materials, components and special components

DIN EN 13501
DIN EN 13501-1:2010-01: Fire classification of construction products and building elements – Part 1: Classification using data from reaction to fire tests; German version EN 13501-1:2007 + A1:2009

DIN EN 197-1
DIN EN 197-1:2011-11: Cement – Part 1: Composition, specifications and conformity criteria for common cement; German version EN 197-1:2011

European Waste Catalogue
European Waste Catalogue (EWC) in the version of the Commission Decision 2001/118/EC dated 16 January 2001 amending Decision 2000/532/EC on a waste directory

GaBi software
GaBi 6: Software and data base for comprehensive analysis. LBP, University of Stuttgart and PE International, 2013

GaBi documentation
GaBi 6: Documentation of GaBi 6 data sets from the data base for comprehensive analysis LBP, University of Stuttgart and PE International, 2013. http://documentation.gabi-software.com/

E DIN 4109-32
DIN 4109-32:2013-11: Sound insulation in buildings – Part 32: Input data for verifying sound insulation by calculation (parts catalogue) – Solid structures (draft standard)

DIN 4108-4
DIN 4108-4:2013-02: Thermal insulation and energy economy in buildings – Part 4: Hygrothermal design values

DIN V 20000-404
DIN V 20000-404:2006-01: Application of building products in structures – Part 04: Rules for the application of autoclaved aerated concrete masonry units according to DIN EN 771-4

DIN V 4165-100
DIN V 4165-100:2005-10: Autoclaved aerated concrete masonry units – Part 00: High-precision units and elements with specific properties

DIN 4166
DIN 4166:1997-10: Autoclaved aerated concrete slabs and panels

DIN EN 771-4
DIN EN 771-4:2011-07: Specification for masonry units – Part 4: Autoclaved aerated concrete masonry units; German version EN 771-4:2011

DIN 1053-1
DIN 1053-1:1996-11 – Masonry; Part 1: Calculation and performance

DIN EN 459
DIN EN 459-1:2010-12: Building lime – Part 1: Definitions, specifications and conformity criteria; German version EN 459-1:2010

DIN 1169
DIN EN 1169:1999-10: Precast concrete products – General rules for factory production control of glass-fibre reinforced cement; German version EN 1169:1999

DIN 1996 (EC 6)
Eurocode 6 for Germany - DIN EN 1996: Design of masonry structures with national annexes; version with comments, 2013:11

DIN EN 680
DIN EN 680:2006-03: Determination of the drying shrinkage of autoclaved aerated concrete; German version EN 680:2005

Rules of the professional associations
BG Bau: Professional association for the building industry, BGI 695 leaflet on handling masonry units, October 1992

European Commission "Radiation Protection 112" Directive
European Commission: Radiological Protection Principles concerning the Natural Radioactivity of Building Materials, 1999

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