Environmental Product Declaration

as per ISO 14025 and EN 15804

Owner of the declaration:	BauMineral GmbH
Publisher:	BCS Öko-Garantie GmbH - Ecobility Experts
Programme holder:	BCS Öko-Garantie GmbH - Ecobility Experts
Declaration number:	EPD-Baumineral-030-DE
Issue date:	11.12.2017
Valid to:	11.12.2022

Grobalith® SCHOLVEN

This Environmental Product Declaration (EPD) refers to 1 t bottom ash from the power plant Scholven. Bottom ash is a coal combustion byproduct. It is used as a construction material in structural and civil engineering.

1. General information

BauMineral GmbH

Programme holder
BCS Öko-Garantie GmbH - Ecobility Experts
Marientorbogen 3-5
90402 Nürnberg
Deutschland/Germany

Declaration number
EPD-Baumineral-030-DE

This declaration is based on the Product Category Rules
"Produktkategorieregeln für Kraftwerksnebenprodukte – Anforderungen an Umwelt-Produktdeklarationen für Kraftwerksnebenprodukte"
Product category rules for power plant by-products – requirements on Environmental Product Declaration for power plant by-products
issue 2017-06
(tested and approved by the independent expert committee)

Issue date
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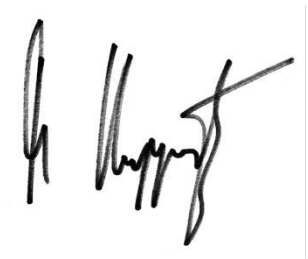


Signature
Ppa. Frank Huppertz
(President of Kiwa BCS Öko-Garantie GmbH - Ecobility Experts GmbH)

Signature
Prof. Dr. Frank Heimbecher
(Chairman of the independent expert committee BCS Öko-Garantie GmbH – Ecobility Experts GmbH)

Grobalith® SCHOLVEN

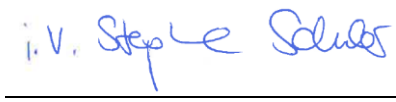
Owner of the declaration
BauMineral GmbH
Hiberniasstraße 12
D-45699 Herten

Declared product/ declared unit
1 t bottom ash

Scope
Grobalith® SCHOLVEN is a bottom ash from the power plant Scholven. Bottom ash is produced during electricity generation in hard coal-fired power stations.
Bottom ashes fall to the bottom of the combustion chamber and are collected in a water-filled hopper at the boiler end. The declaration is valid for bottom ash Grobalith® SCHOLVEN by BauMineral GmbH.
The owner of the declaration shall be liable for the underlying information and evidence. BCS Öko-Garantie GmbH – Ecobility Experts 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

✓internally ☐externally



Signature
Dr. Stephanie Schuler,
(Intern verifier of Kiwa GmbH)

2. Product

2.1 Product description

Bottom ash Grobalith® SCHOLVEN is produced in the boiler room of the power plant Scholven, resulting from the agglomerated, melted mineral compounds of hard coal and thus a coal combustion by-product. Bottom ash is not extracted with the flue gases, but collected in a water-filled hopper at the boiler end. Due to its physical properties bottom ash is applicable in a large variety. Similar to hard coal fly ash its chemical-mineralogical composition results from the used type of coal and varies from residual carbon and minerals to trace elements. Bottom ash is highly porous and in terms of its particle density comparable with natural lightweight aggregates. Bottom ash has irregularly ruptured, coarse surfaces and is suitable for the production such as light concrete products and light bricks.

2.2 Application

According to DIN EN 13055 bottom ash Grobalith® is used in the construction industry as lightweight aggregate for concrete, mortar and grout. It is suitable for the production of light concrete products and light bricks, Scholvenich are typified by low weight and good heat insulating features. Other fields of application for bottom ash Grobalith® include road construction, as well as backfilling, embanking and soil improvement measures.

2.3 Technical Data

The technical data for the bottom ash Grobalith® SCHOLVEN is shown in the following table. The values refer to the yearly average value of 2015.

Name	Value	Unit
Elutriable components grain content < 0,063 µm	< 10	M.-%
Elutriable components after impact stress at Proctor test	< 15	M.-%
Grain solidness – value of slag disintegration	25 – 35	M.-%
Bulk density /EN 1744-1; DIN EN 10355-1/	0,6 – 0,8	t/m^3
Particle density /EN 1097-6:2000, appendix C/	1,1 -1,4	t/m^3
Water absorption /EN 1097-6:2000 appendix C/	20 - 30	M.-%
Moisture content	25 -35	M.-%
Loss on ignition/EN 1744-1; DIN EN 10355-1/	< 10	M.-%
Sulphur /EN 1744-1/	< 1	M.-%
Sulphate acid-soluble /EN 1744-1/	0,1	M.-%
Chloride /EN 1744-1/	< 0,01	M.-%

2.4 Placing on the market / Application rules

Quality management of bottom ash conforms to DIN EN 13055-1. The accomplishment of the requirements of DIN EN 13055-1 is marked with a CE-Label. For the placing on the market (EU) No.305/2011 dated from 9 March applies. For the application and use of the products the European provisions apply.

2.5 Base materials / Ancillary materials

The composition of hard coal fly ash depends on the mineral components of the applied combustible, which is mainly composed of hard coal. In the following table average values of main components of EFA Füller® hard coal fly ash are given.

Parameter	Value	Unit
SiO_2	55	M.-%
Al_2O_3	23	M.-%
Fe_2O_3	7	M.-%
CaO	4	M.-%
MgO	2	M.-%
K_2O	2	M.-%
Na_2O	1	M.-%

2.6 Manufacture

Bottom ash Grobalith® occurs inevitably as a solid, disperse residue during the combustion process in the power station. The aim of the power plant is the generation of electricity and heat. Bottom ash is produced in dry firing boilers and collected in a water-filled hopper at the end of the boiler, which seal the boiler hermetically. Bottom ashes are stored in heaps on the power plant site and transported with trucks to the customer. Generally, the trucks transport 25 to 27 t of bottom ash.

2.7 Reference service life

The declaration of Reference service life is voluntarily, since the extent of the study is not considering the whole life cycle of the bottom ash. Bottom ash is used as lightweight aggregate in concrete products. According to the BBSR-table 2011 / Nr. 363.512 the reference service life of concrete components amounts to ≥ 50 years.

3. LCA: Calculation rules

3.1 Declared unit

The declared unit is 1 t of bottom.

	Value	Unit
Declared unit	1	t
Conversion factor to 1 kg	1000	-

3.2 System boundary

The Environmental Product Declaration is a cradle-to-gate EPD, i.e. all potential environmental impact are considered from cradle until factory gate. The generation of bottom ash during the power production with hard coal is inevitable. The aim of a hard coal power station is the production of energy; therefore the potential environmental impacts of the energy production are allocated to the power station. For this reason, the combustion chamber is located is beyond the system boundary. All transport and storage processes (until the factory gate) are inside the system boundary. Thus, the system boundary of the manufacturing stage is the finished product at the factory gate. According to DIN EN 15804 this corresponds to the product phases A1-A3.

3.3 Estimates and assumptions

The power station Heyden in Petershagen is assumed as the reference power station, because all consumptions due to transports and energy are equal for the different power station, which are the source for bottom ashes from Baumineral. The data regarding Grobalith® SCHOLVEN represents the consumption of all fly ashes from Baumineral.

The bottom ash is stored in heads on the respective power plant site and transported with trucks to the customer. Generally, the trucks transport 25 to 27 t of bottom ash. During the storage stage in heads no additional expenses occur (no heating, no cooling, no aeration) and thus no energy consumption. The estimated distance between bottom ash storage site and factory gate is 500m, which is the worst-case-scenario for all power stations. A truck of 27 t maximum payload and 40 t total weight is presumed (diesel vehicle). The occupancy rate is assumed as 85 percent.

3.4 Cut-off criteria

All process specific data is compiled for the production modules A1 to A3. All flows that contribute more than 1 % to the total mass, energy or environmental impact of the system, are considered in the LCA. It can be assumed that the sum of all neglected processes is less than 5 % of all considered impact categories.

3.5 Period under review

The data set employed in the EPD is based on 2015 production data.

3.6 Comparability

Basically, a comparison or an evaluation of EPD data is only possible if all the data sets were created according to the EN 15804. Product-specific characteristics must be considered. Secondary data for the stage of manufacture is exclusively obtained from the database Gabi 6.

4. LCA: Scenarios and additional technical information

No scenarios were analysed in this EPD.

5. LCA: Results

The following tables show the results of the indicators of the impact assessment, the resource input as well as the waste materials and other output-flows. The here shown results refer to the declared unit.

Description of the system boundary (X = Included in LCA; MND = Module not declared)															
Product stage			Construction process stage		User stage							End of life stage				Benefits and loads beyond the system boundaries
Raw material supply	Transport	Manufacturing	Transport from manu-facturer to place of use	Construction-installation process	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

Results of the LCA – Environmental impact: 1 t bottom ash Grobalith®SCHOLVEN		
Parameter	**Unit**	**A1 – A3**
Global warming potential	[kg CO_2-Eq.]	2,35E-02
Depletion potential of the stratospheric ozone layer	[kg CFC11-Eq.]	2,90E-14
Acidification potential of land and water	[kg SO_2-Eq.]	1,04E-04
Eutrophication potential	[kg $(PO_4)^3$-Eq.]	2,84E-05
Formation potential of tropospheric ozone photchemical oxidants	[kg Ethen-Eq.]	-3,59E-05
Abiotic depletion potential for non fossil resources	[kg Sb-Eq.]	1,21E-09
Abiotic depletion potential for fossil resources	[MJ]	3,20E-01

Results of the LCA – Resource use: 1 t bottom ash Grobalith®SCHOLVEN		
Parameter	**Unit**	**A1 – A3**
Renewable primary energy as energy carrier	[MJ]	2,45E-02
Renewable primary energy resources as material utilization	[MJ]	IND
Total use of renewable primary energy resources	[MJ]	2,45E-02
Non renewable primary energy as energy carrier	[MJ]	3,21E-01
Non renewable primary energy as material utilization	[MJ]	IND
Total use of non renewable primary energy resources	[MJ]	3,21E-01
Use of secondary material	[kg]	IND
Use of renewable secondary fuels	[MJ]	IND
Use of non renewable secondary fuels	[MJ]	IND
Use of net fresh water	[m^3]	1,41E-05

Results of the LCA – Output flows and waste categories: 1 t bottom ash Grobalith®SCHOLVEN		
Parameter	**Unit**	**A1 – A3**
Hazardous waste disposed	[kg]	2,59E-07
Non hazardous waste disposed	[kg]	2,16E-03
Radioactive waste disposed	[kg]	4,27E-07
Components for re-use	[kg]	IND
Materials for recycling	[kg]	IND
Materials for energy recovery	[kg]	IND
Exported electrical energy	[MJ]	IND
Exported thermal energy	[MJ]	IND

6. LCA: Interpretation

The potential environmental impacts of bottom ash result from the storage and transport. No indirect environmental aspects occur during the storage in heaps. The environmental effects of bottom ash production are caused by the transport.
The photochemical Formation potential of tropospheric ozone (POCP) has an overall negative value. It is caused by the direct emission during transport. The ozone is decomposed by the reaction with the emitted nitrogen monoxide, thus nitrogen dioxide and oxygen are formed. This has a positive effect on the photochemical formation potential of tropospheric ozone (POCP).

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