ENVIRONMENTAL PRODUCT DECLARATION

as per /ISO 14025/ and /EN 15804/

Owner of the Declaration	DURAVIT AG
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-DUR-20170167-IBC1-EN
Issue date	14/03/2018
Valid to	13/03/2023

Bathtubs and shower trays made from mineral cast (Durasolid® A)

DURAVIT AG

Institut Bauen und Umwelt e.V.

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1. General Information

DURAVIT AG

Bade- und Duschwannen aus Durasolid®

Programme holder
IBU - Institut Bauen und Umwelt e.V.
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Germany

Owner of the declaration
DURAVIT AG
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78132 Hornberg
Deutschland

Declaration number
EPD-DUR-20170167-IBC1-EN

Declared product / declared unit
The EPD refers to bathtubs and shower trays made from mineral cast with a declared unit of 1 m² mineral cast surface. An average product was reviewed based on the respective production volumes.

This declaration is based on the product category rules:
Sanitary products made from composite materials, 09.2017 (PCR checked and approved by the SVR)

Scope:
This EPD concerns all products made from mineral cast by DURAVIT AG, i.e. bathtubs and shower trays in various designs and sizes, including packaging and installation accessories. The production site is the DURAVIT plant in Bischwiller, France. This is a manufacturer's declaration for an average product at one site.

Issue date
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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 standard /EN 15804/ serves as the core PCR
Independent verification of the declaration and data according to /ISO 14025:2010/
☐ internally ☒ externally

Prof. Dr.-Ing. Horst J. Bossenmayer
(President of Institut Bauen und Umwelt e.V.)

Dipl. Ing. Hans Peters
(Head of Board IBU)

Angela Schindler
(Independent verifier appointed by SVR)

2. Product

2.1 Product description / Product definition

The Durasolid® product group includes bathtubs and shower trays.
They are available for various installation requirements and in a variety of designs and sizes. The Durasolid material primarily comprises inorganic fillers and a synthetic resin, and is distinguished by its particular haptics.
Directive /(EU) No. 305/2011/ (CPR) applies for placing the product on the market in the EU/EFTA (with the exception of Switzerland). The product requires a Declaration of Performance taking consideration of the /EN 14516:2015: Bathtubs for domestic purposes/, /EN 14527:2016: Shower trays for domestic purposes/ and CE marking.

Use is governed by the respective national regulations.

2.2 Application

Bathtubs and shower trays are furnishing items for bathrooms and are used for personal hygiene in particular.
Shower trays can be installed directly or using a pedestal or tray support. A soundproofing base for bathtubs is preinstalled in the factory. Bathtubs can be converted into whirlpools by assembling further accessory parts.

2.3 Technical Data

Durasolid® products display the following characteristics:

Construction data

Name	Value	Unit
Width x length (bathtubs)	800 - 900 x 1800 - 1900	mm
Width x length (shower trays)	800 - 900 x 900 - 1400	mm
Sound insulation class acc. to DIN EN 4109/	Standard met	-
Chemical resistance acc. to DIN EN 14516/14527 (for bathtubs and shower trays)	passed	-

Anti-slip classification acc. to DIN EN 51097/ (for bathtubs and shower trays)	B	-
Temperature change resistance acc. toDIN EN 14516/DIN EN 14527/ (for bathtubs and shower trays)	passed	-

Product performance values in line with the Declaration of Performance with reference to its essential features in accordance with /EN 14516:2015 Bathtubs for domestic use/ and /EN 14527:2016 Shower trays for domestic use/

2.4 Delivery status

The following dimensions apply for bathtubs:
2065 x 1100 x 845 mm Packaged bathtubs weigh 107-115 kg/unit.
The following dimensions apply for shower trays:
1490 x 940 x 80 mm Packaged shower trays weigh 19-33 kg/unit.

2.5 Base materials / Ancillary materials

As a material, Durasolid® has various compositions for bathtubs and shower trays. It comprises:

- Inorganic fillers: 47-57%
- Unsaturated polyester resin: 39-50%
- Titanium dioxide: 1.8-2.5%
- Catalyst: < 1%

2.6 Manufacture

The manufacturing process can be described as follows:
Goods inspection is carried out on delivery of the respective raw materials. After acceptance, the raw materials are weighed online using a mixing plant and in line with the corresponding formula, and homogenised as the mineral cast mass. The mass is cast in moulds after homogenisation.

After polymerisation of the material, the products are removed from the moulds and set on supporting moulds. Then the products are tempered in the furnace which reduces intrinsic stresses in the material. The furnace is powered exclusively by waste heat from the neighbouring sanitary ceramic production.

After tempering, the products are reworked where, depending on the model and product group, they are joined, milled, ground and polished if necessary. Metal feet are always pre-assembled on bathtubs.

For the purpose of quality assurance, all models are regularly examined for their resistance to chemicals, changes in temperature and tightness.

2.7 Environment and health during manufacturing

As a general rule, DURAVIT AG endeavours to minimise the impacts of production on man and the environment. Accordingly, filters have been installed, for example, to keep harmful emissions for employees significantly below the specified limit values.

Furthermore, the production site operates environmental and energy management certified to /ISO 14001/ and /ISO 50001/. Numerous measures have already been implemented. For example: the furnace is exclusively powered using waste heat, there is a closed process water circuit and 80% of solvents are reprocessed and reused via distillation. Furthermore, all raw materials, auxiliaries and consumables are approved in accordance with /REACH/.

2.8 Product processing/Installation

Installation of the products does not require any particular use of machines. Any auxiliaries and tools required are listed in the enclosed assembly instructions.

2.9 Packaging

The products are wrapped in PE foil, edges are protected by foam profiles and packed in suitable cardboard packaging. The products are then placed on suitable disposable wooden pallets.

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2.10 Condition of use

There are no particular features of material composition during use of the products.

2.11 Environment and health during use

During the use of Durasolid® products, no indications of interactions between the product, the environment and health could be identified.

Mineral cast is resistant to typical domestic cleaning agents.

A voluntary examination for polycyclic aromatic hydrocarbons (PAH) in accordance with the /ZEK 01.4-08/ standard established that the material is to be classified in category 2. The verified total volume of PAH is 0.5 mg/kg.

2.12 Reference service life

The use phase is not a component of this Environmental product Declaration. When used and cared for as designated, a use phase of several generations can however be achieved.

2.13 Extraordinary effects

Fire

The material is normally flammable (Class E) although mineral cast is only subject to edge flaming. The flame automatically extinguishes in only a few seconds on removal of the fire source.

Fire protection

Name	Value
Building material class	Class E
Burning droplets	d0
Smoke gas development	s1

Water

In the event of unforeseen impact by water on Durasolid® products, no negative impacts are to be anticipated on either the product or the environment.

Mechanical destruction

No environmental effects are known in the event of mechanical destruction.
No negative impacts on product function are to be anticipated in the event of minor superficial damage

(scratches, minor chipping). Repairs can be carried out using the repair kit provided.

2.14 Re-use phase

Open-loop recycling of mineral cast is generally possible, even if it is not currently commercially feasible. Material recycling in the down-cycling process for use in road construction, for example, is also possible but is currently not applied as the material volumes are still too low.

2.15 Disposal

Durasolid® products can be disposed of in co-ordination with the responsible local disposal companies and in accordance with the respective waste disposal guidelines.

The following waste keys can be indicated for the bathtubs and shower trays and their respective packaging components:

- Cardboard: 150101 Paper and cardboard packaging
- Foam and foil:150102 Plastic packaging
- Wooden pallet:150103 Wooden packaging
- Cast mineral material: 170107 Mixtures of concrete, bricks, tiles and ceramic

2.16 Further information

Additional information available online at www.duravit.de.

3. LCA: Calculation rules

3.1 Declared Unit

A declared unit of 1m² mineral cast surface is taken as a basis for calculating the environmental impacts of the bathtubs and shower trays made from mineral cast. An average bathtub and shower tray product including the soundproofing feet, bases and support trays used for installation as well as primary, secondary and tertiary packaging of the end products is reviewed on the basis of the total production volumes during the period under review (01.05.2016 to 30.04.2017).

Declared unit

Name	Value	Unit
Declared unit mineral cast surface	1	kg/m²
Declared unit accessories	0.33	m²
Mass Mineral cast mass of declared unit	22.82	kg
Mass Packaging mass	895	kg
Conversion factor to 1 kg with accessories and packaging	0.03	-

3.2 System boundary

The “Cradle to plant gate - with options” system boundary was applied for this EPD. The LCA model comprises all of the relevant process steps of manufacturing bathtubs and shower trays made from mineral cast (product stages A1 - A3). It also includes disposal of the bathtubs and shower trays (incineration with energy recovery, Module C3) and potential credits (Module D) arising from incineration in C3. The relevance of inputs and outputs was defined on the basis of their potential environmental impact and the cut-off criteria in /EN 15804/.

The following processes are within the system boundaries:

Modules A1-A3:

- Extraction and processing of relevant raw materials, auxiliaries and consumables
- Production of soundproofing feet, frames and tray supports
- Production of packaging (primary, secondary and tertiary packaging)
- Transport of raw materials, auxiliaries, consumables, preliminary products and packaging components to the plant
- Production of bathtubs and shower trays made from mineral cast
- Treatment of waste incurred during production and use of the energy recovered during waste treatment

Module C3:

- Waste pre-treatment of bathtubs and shower trays made from mineral cast
- Incineration in a waste incineration plant

Module D:

- Avoided loads through energy recovery during waste incineration in C3
- Avoided loads through recycling metals

3.3 Estimates and assumptions

Within the framework of the study, a few exceptions needed to be made concerning truck utilisation capacity and emissions classes, transport distances, losses or collection rates. They do not however have any major influence on the results of the LCA. Many of the assumptions are made transparent in section 4.

Furthermore, individual material flows were substituted by data inventories of similar production processes in an effort to close any data gaps.

3.4 Cut-off criteria

The cut-off criteria in accordance with /EN 15804/ were adhered to.

3.5 Background data

Primarily processes from /GaBi/, version 8.0 were used for modelling the LCA. Data sets from the ecoinvent data base /ecoinvent/, version 3.3, were also applied. Individual processes from /ELCD/ were used.

3.6 Data quality

The overall data quality can be classified as good. The data sets used comply with the requirements on data quality in /EN 15804/.

The primary processes were modelled with the aid of manufacturer data from 2016 and 2017.

83% of the processes used from LCA data bases are no more than 5 years old.

ecoinvent data sets were re-modelled in GaBi with country-specific data sets for electricity and heat and without infrastructure data in an effort to achieve maximum representativity and consistency of the model.

3.7 Period under review

Primary data was collated for the period 01.05.2016 to 30.04.2017.

3.8 Allocation

Allocation of auxiliaries and consumables used: In primary processes, auxiliaries and consumables were not allocated as the virtual product depicts the entire production process. The production of Durasolid® products is separate from that of other products enabling separate data collation.

Allocations in the use of recycled materials: Secondary materials used enter the system unencumbered.

Allocation of credits from recycling and thermal utilisation of packaging materials and production waste: Credits arising from thermal utilisation of production waste are back-looped within A1-A3. Credits from packaging materials are not included in the system as A5 is not part of the LCA.

3.9 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.

The used background database has to be mentioned.

4. LCA: Scenarios and additional technical information

End of Life (C1-C4)

Name	Value	Unit
Collected separately (mineral cast, plastics, metal)	21.37	kg
Collected as mixed construction waste	0	kg
Reuse	0	kg
Recycling (stainless steel)	0.08	kg
Energy recovery (mineral cast, plastics)	21.29	kg
Landfilling	0	kg

Re-use, recovery and recycling potential (D), relevant scenario information

Name	Value	Unit
Waste collection rate	95	%

5. LCA: Results

Environmental impacts were calculated with CML 2001 in the version dated April 2015.

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE NOT DECLARED)

PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARIES
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	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	MNR	MNR	MNR	MND	MND	MND	MND	X	MND	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT: 1m² bathtubs and shower trays made from mineral cast

Parameter	Unit	A1-A3	C3	D
Global warming potential	[kg CO_2-Eq.]	4.55E+1	2.78E+1	-8.55E+0
Depletion potential of the stratospheric ozone layer	[kg CFC11-Eq.]	5.24E-8	3.25E-8	-2.70E-9
Acidification potential of land and water	[kg SO_2-Eq.]	9.40E-2	3.29E-3	-1.64E-2
Eutrophication potential	[kg $(PO_4)^{3-}$-Eq.]	1.09E-2	7.60E-4	-1.59E-3
Formation potential of tropospheric ozone photochemical oxidants	[kg ethene-Eq.]	1.60E-2	2.83E-4	-9.51E-4
Abiotic depletion potential for non-fossil resources	[kg Sb-Eq.]	8.99E-5	-3.13E-6	-1.96E-5
Abiotic depletion potential for fossil resources	[MJ]	1.02E+3	5.65E+0	-2.20E+2

RESULTS OF THE LCA - RESOURCE USE: 1m² bathtubs and shower trays made from mineral cast

Parameter	Unit	A1-A3	C3	D
Renewable primary energy as energy carrier	[MJ]	9.66E+1	6.05E-1	-8.39E+0
Renewable primary energy resources as material utilization	[MJ]	1.32E+2	0.00E+0	0.00E+0
Total use of renewable primary energy resources	[MJ]	2.29E+2	6.05E-1	-8.39E+0
Non-renewable primary energy as energy carrier	[MJ]	8.66E+2	2.27E+2	-7.29E+1
Non-renewable primary energy as material utilization	[MJ]	2.24E+2	-2.18E+2	0.00E+0
Total use of non-renewable primary energy resources	[MJ]	1.09E+3	8.04E+0	-7.29E+1
Use of secondary material	[kg]	4.96E+0	0.00E+0	0.00E+0
Use of renewable secondary fuels	[MJ]	0.00E+0	0.00E+0	0.00E+0
Use of non-renewable secondary fuels	[MJ]	0.00E+0	0.00E+0	0.00E+0
Use of net fresh water	[m³]	2.50E-1	8.83E-2	-3.28E-2

RESULTS OF THE LCA – OUTPUT FLOWS AND WASTE CATEGORIES: 1m² bathtubs and shower trays made from mineral cast

Parameter	Unit	A1-A3	C3	D
Hazardous waste disposed	[kg]	9.73E-7	2.80E-9	-1.31E-7
Non-hazardous waste disposed	[kg]	6.50E+1	7.78E+0	-3.16E+1
Radioactive waste disposed	[kg]	2.63E-2	5.64E-4	-1.90E-2
Components for re-use	[kg]	0.00E+0	0.00E+0	0.00E+0
Materials for recycling	[kg]	0.00E+0	0.00E+0	0.00E+0
Materials for energy recovery	[kg]	0.00E+0	0.00E+0	0.00E+0
Exported electrical energy	[MJ]	0.00E+0	2.45E+1	0.00E+0
Exported thermal energy	[MJ]	0.00E+0	5.67E+1	0.00E+0

Each of the life cycle inventory analysis parameters were considered for the entire module, including the upstream chains. Apart from the use of energy carriers, the energy parameters also include the energy contained in the product, accessories and packaging.

6. LCA: Interpretation

Relevant life cycle phases

In all impact categories, the greatest environmental effects were caused by the manufacturing phase of the bathtubs and shower trays (Modules **A1 – A3**) (see Fig. 1). Depending on the impact category, environmental effects are dominated by the manufacturing phase accounting for a share of 55% to 90%,
whereby the greatest share is attributable to the provision of preliminary products. Actual manufacturing of the mineral cast products does not have any significant environmental impact and the same applies for transporting the preliminary products, raw materials, auxiliaries and consumables to the plant.

The disposal phase (**C3**) makes the greatest contribution towards ozone depletion potential (ODP) and global warming potential (GWP), accounting for 38% and 35%, respectively, of the overall result. In the remaining impact categories, the influence of C3 is significantly lower at ≤ 5%.

Relevant processes
Within **A1 – A3**, the manufacture of polyester resin accounts for the highest environmental impact in all impact categories, with the exception of ODP, accounting for 45 to 85%. On account of the system processes in GaBi, it is not possible to further analyse the exact origin of these effects.
Despite its low volume, stainless steel has a major influence. In the categories of ODP and abiotic depletion potential of non-fossil resources (ADPE) in particular, it makes a relevant contribution to the overall result of 87% and 27%, respectively. Stainless steel production also causes visible environmental impact in the case of acidification potential (AP) where it accounts for around 10%.
Aluminium hydroxide represents the process making the third-highest contribution. In the categories of GWP, AP and abiotic depletion potential of fossil fuels (ADPF), it causes approx. 10% of potential environmental damage in each category. In the impact categories of eutrification potential (EP), photochemical ozone creation potential (POCP) and ADPE, aluminium hydroxide accounts for approximate shares of 4-5% of overall results.

Titanium dioxide also has a relatively strong influence on the results compared to the volume actually used. It makes its greatest contribution to the EP impact category accounting for around 30%, followed by AP with almost 10%. It accounts for 3-5% of GWP, POCP, ADPE and ADPF.

The wooden pallet makes a negative contribution to GWP, accounting for approx. 6%. This is attributable to the biogenic CO2 stored in the product. However, it involves a disposable pallet whose stored CO2 is re-emitted during incineration which is not included in the model.

A negative numeric value is also visible in the POCP category which is attributable to various transport processes emitting nitrogen monoxide. Nitrogen monoxide has a negative characterisation factor in the estimated impact method.

In comparison to the manufacturing processes for individual materials outlined above, the other processes within A1 – A3 only have a low environmental hazard potential.

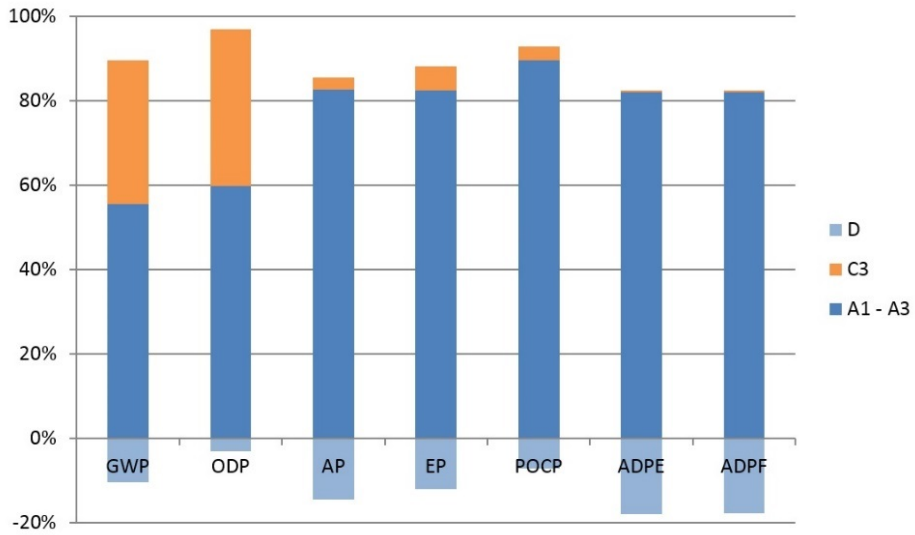

Fig. 1: Overall result of estimated impact

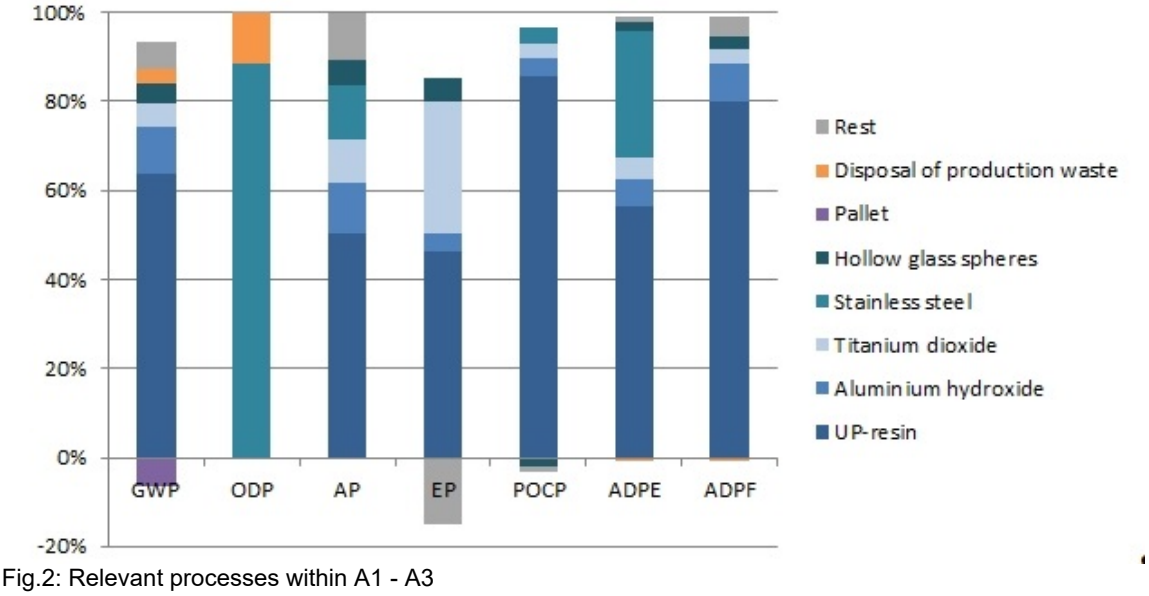

Fig.2: Relevant processes within A1 - A3

7. Requisite evidence

No evidence is required

8. References

ecoinvent: LCA data base, version 3.3, ecoinvent Association, Zurich

ELCD: European Life Cycle Datasets, version 3.3, Joint Reearch Centre, Ispra

GaBi: Software and data base for comprehensive analysis, version 8.0, Chair of Building Physics (LBP) at the University of Stuttgart and thinkstep AG, Leinfelden-Echterdingen

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IBU (2016): General Programme Instructions for the Preparation of EPDs at the Institut Bauen und Umwelt e.V., Version 1.1 Institut Bauen und Umwelt e.V., Berlin.
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/ISO 14025/
DIN EN /ISO 14025:2011-10/, Environmental labels and declarations — Type III environmental declarations — Principles and procedures

/EN 15804/
/EN 15804:2012-04+A1 2013/, Sustainability of construction works — Environmental Product Declarations — Core rules for the product category of construction products

/ISO 14001/
/DIN EN ISO 14001:2015/, Environmental management systems – Requirements with guidance for use

ISO 50001
/DIN EN ISO 50001:2011/, Energy management systems - Requirements with guidance for use

/DIN EN 4109/
/DIN EN 4109:2016/, Sound insulation in buildings

/EN 14516/
/DIN EN 14516:2015/, Bathtubs for domestic use

/EN 14527/
/DIN EN 14527:2016/, Shower trays for domestic use

/EU No. 305/2011/
Directive of the European Parliament and Council establishing harmonised conditions for marketing construction products and replacing Council Guideline 89/106/EEC

REACH
Directive (EC) No. 1907/2006 of the European Parliament and Council on the Registration, Evaluation, Authorisation of Chemicals (REACH)

/ZEK 01.4-08/
/ZEK 01.4-08/, Examination and evaluation of polycyclical aromatic carbons (PAC) for awarding GS marking

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