Institut für **Baubiologie** Rosenheim GmbH

Expert Report

No. 3018 - 966
with reference to the seal of approval

"Tested and Recommended by the IBR"

for the product

Fermacell Powerpanel H_2O

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It is the objective of the IBR to identify non-polluting building products for healthy living for the consumer by awarding the seal of approval "TESTED AND APPROVED BY THE IBR".

The seal of approval was created by the Institut für Baubiologie Rosenheim GmbH in 1982 to enable consumers with awareness for health and ecological matters to protect themselves against health hazards caused by building materials and furniture in their residential environment.
The seal of approval is awarded to products which ensure healthy living with respect to building biology and at the same time protect the environment. When awarding the seal of approval, we only use scientific and technical analysis methods which are based on normative regulations as well as the current state-of-the-art of laboratory analytics so that they should be understood both by third-party experts and by end consumers.
The aim of awarding the seal of approval "TESTED AND RECOMMENDED BY THE IBR" to as many products as possible is to enable an increasing number of consumers and end users to make criteria related to building biology a critical part of their decision when purchasing products for building and furnishing their homes.
The tests listed in our expert reports are not supposed to supersede the requirements in terms of building physics, supervision, legal regulations, or safety. They are merely a complementary set of tests related to health, physiology, building biology, and ecology aspects which have been neglected.
The seal of approval "TESTED AND APPROVED BY THE IBR" is based on a holistic perspective. Besides its focus on the tests that determine the potential physiological impact of the products on human beings and/or the environment, the expert report associated with granting the seal also honours any product whose production, processing, use, and ecological recycling have no or only a limited, tolerable adverse effect on the environment.
The emission of harmful substances, e.g. with a carcinogenic and/or mutagenic potential, is always to be considered as a criterion for exclusion. The seal of approval will under no circumstances be awarded to such products.
Any names of companies, products or brands mentioned in our expert reports are protected by copyright. The fact that we mention them is neither to be construed as a valuation nor as a recommendation in this context.

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1. Product description

For the purpose of awarding the seal of approval, the company has instructed us to subject its product, powerpanel H_2O, to building biology follow-up testing based on follow-up testing conducted in 2016 (expert report no. 3016 - 806). The powerpanel H_2O was collected from the customer on 3rd February 2018 by a MPA representative.

The tested construction panel is made of a light concrete core plate, which is sandwiched between reinforcing layers of alkali-resistant glass fibre mesh (5 x 5 mm), which enhance the material strength and form high-tensile surface connections. The tested construction panels consist entirely of mineral components; therefore, the panels are void of any flammable organic materials and are categorized as class A1 construction material (non-flammable construction materials) according to DIN 4102 and DIN EN 13501-1. The covering layer of glass foam granulate is made of recycled glass. A dosing station is used to place the core material on one of the reinforcing layers. The top glass fibre mesh layer is first injected onto a foil substrate and while still fresh, the top layer is placed on the also still fresh core material. After the construction plate has sufficiently hardened, the foil substrate is removed and the panel is taken out of its mould. Technical drying follows the initial hardening of the panels. Finally, horizontal and vertical trimming and edging give the panels their standard size. The panels are then palletised and after proper curing, they are packaged and prepared for shipping. The panel surfaces are also fit for plastering and stucco work. The panels are mostly used in the construction of wet rooms like bathrooms, building elements in contact with water (toilets, wash facilities, etc.), public and home wellness facilities, home and commercial kitchens, industrially used areas (e. g. areas exposed to chemicals); [ETA 07/0087 (European Technical Approval)]. Usually, the construction panels are coated with water-tight materials and then tiled or covered with ceramic materials. A plastering of surfaces is also possible. The need to use personal protective equipment when processing the material within the scope of the standards stipulated by the employer's liability insurance associations is pointed out explicitly. Persons charged with processing these materials can make use of readily available assistance. Comprehensive product information and processing regulations can be viewed on the manufacturer's Internet site or can be found in the product-specific printed documentation.

It is subject to constant third party monitoring and controls by the manufacturer.

The local application of additives or coating which might be necessary is not part of the examination. For more detailed specifications, please contact the manufacturer.

The required safety data sheets were submitted to us for review.

There are no issues with respect to safe disposal. There are no hazardous components to be disclosed.

2. Test results

2.1 Radioactivity

Natural radiation exposure is composed of cosmic and terrestrial radiation. Humans are mainly subject to internal exposure due to radon gas. In addition to radon in ground air due to geological conditions, an increased concentration of radon may be found in living spaces because of certain building materials. Breathing in the gas over a long period of time may expose the lungs to radioactive radiation. While most radon particles are exhaled again, its radioactive decay products can be deposited in the lungs. In 1999, the Radiation Protection 112 document issued by the European Commission proposed an Activity Concentration Index (ACI) for building materials. The limit is ACI ≤ 1.00 while the Institut für Baubiologie Rosenheim sets the ACI limit at ≤ 0.75. Gamma-spectrometry is used to determine the natural radioactivity.

Evaluation:
The tested boards with a value of 0.54 are below the allowable limits and are therefore safe in regards to radiation exposure.

2.2 Biocides, pyrethroids, OHCs, phthalates

Biocides, pyrethroids, organic halogenated compounds (OHCs) or phthalates are added to different building materials to produce various properties such as pest resistance and durability, or also for technical processing reasons. Organic halogenated compounds are further differentiated into AOX (adsorbable organic halogens), POX (purgeable organic halogens) and EOX (extractable organic halogens) according to DIN 1485. In order to prevent the impairment of health due to the classes of compounds named above, limit values have been established for safe use of the building materials in living spaces and these should not be exceeded.

2.2.1 Biocides

Test method: several hours of soxhlet extraction with n-hexane respectively methanol and qualitative/quantitative gas chromatography with mass spectrometry (GC-MS)

PCP/TCP-analysis: Derivation with acetic anhydride under alkaline conditions.

Substance	Measured value [mg/kg]	Limit of detection [mg/kg]
Pentachlorophenol PCP	-	0.1
2,3,4,5 – Tetrachlorophenol	-	0.1
2,3,5,6 – Tetrachlorophenol	-	0.1

beta – HCH	-	0.3
gamma – HCH (Lindane)	-	0.3
Dichlofluanid	-	0.3
Tolylfluanid	-	0.3
Chlorthalonil	-	0.3
alpha – Endosulfan	-	0.3
beta – Endosulfan	-	0.3
Endosulfan – sulphate	-	0.3
Furmecyclox	-	0.3
Hexachlorobenzene	-	0.3
Methylparathion	-	0.3
Ethylparathion	-	0.3
Chlorpyriphos	-	0.3
Heptachlor	-	0.3
Aldrin	-	0.3
cis – heptachlor epoxide	-	0.3
trans – heptachlor epoxide	-	0.3
cis – chlordane	-	0.3
trans – chlordane	-	0.3
Endrin	-	0.3
Dieldrin	-	0.3
Bromophos	-	0.3
Mirex	-	0.3
Malathion	-	0.3
Hexachlorophene	-	0.3
o,p – DDT	-	0.3
o,p‘ – DDT	-	0.3
o,p – DDD	-	0.3
p,p‘ – DDD	-	0.3
o,p – DDE	-	0.3
p,p‘ – DDE	-	0.3
Eulan	-	0.3
Chlornaphtalin	-	0.3
Dichlorvos	-	0.3
IPBC	-	0.3
Propiconazol	-	0.3
Tebuconazol	-	0.3
Cyproconazol	-	0.3
Silafluofen	-	0.3
Etofenprox	-	0.3
Resmethrin	-	0.3
Deltamethrin	-	0.3
Tetramethrin	-	0.3
Cypermethrin	-	0.3
Cyfluthrin	-	0.3
cis – trans – Permethrin	-	0.3
Allethrin	-	0.3
Phenothrin	-	0.3
Cyhalothrin	-	0.3

2.2.2. Polychlorinated biphenyls

Test method: Extraction and qualitative/quantitative gas chromatography with mass spectrometry (GC-MS) (DIN ISO 10382)

Substance	Measured value [mg/kg]	Limit of detection [mg/kg]
Polychlorinated biphenyls (PCB) no.: 28	-	0.02
Polychlorinated biphenyls (PCB) no.: 52	-	0.02
Polychlorinated biphenyls (PCB) no.: 101	-	0.02
Polychlorinated biphenyls (PCB) no.: 138	-	0.02
Polychlorinated biphenyls (PCB) no.: 153	-	0.02
Polychlorinated biphenyls (PCB) no.: 180	-	0.02
Polychlorinated biphenyls PCB: – in total	-	0.1

2.2.3 Phthalate

Test method: Extraction following DFG-S19 and qualitative/quantitative gas chromatography with mass spectrometry (GC-MS) (GC-MS)

Substance	Measured value [mg/kg]	Limit of detection [mg/kg]
Phthalic acid anhydride	-	1
Dimethyl phthalate	-	1
Diethyl phthalate	-	1
Diisobutylphthalat(Bis-2-methylpropylphthalat) DiBP	-	1
Di-n-butyl phthalate DBP	-	1
Benzylbutyl phthalate BBP	-	1
Dioctyl phthalate DOP	-	1
Diisononyl phthalate DINP	-	1
Didecyl phthalate	-	1
Di(2-ethylhexyl) adipate	-	1
Di(2-ethylhexyl) phthalate DEHP	-	1

2.2.4 Flame retardants

Test method: Extraction following DFG-S19 and qualitative/quantitative gas chromatography with mass spectrometry (GC-MS) (GC-MS)

Substance	Measured value [mg/kg]	Limit of detection [mg/kg]
Pentabrominated diphenyl ether (Penta-BDE)	-	1
Octabrominated diphenyl ether (Octa-BDE)	-	1
Decabrominated diphenyl ether (Deca-BDE)	-	1
Tetrabisphenol A (TBBPA)	-	1
Hexabromocyclododecane (HBCD)	-	1
Polybrominated bipyhenyls(PBB)	-	1
Polybrominated diphenyl ether (PBDE)	-	1

Chlorinated paraffins	-	100
Mirex	-	1
Tris(2-chloroethyl) phosphate (TCEP)	-	0.1
Tris(2-ethylhexyl) phosphate (TEHP)	-	0.1
Tris(monochloropropyl)phosphate (TDCPP)	-	0.1
Tris(2-butoxyethyl) phosphate	-	0.1
Triphenylphosphate (TPP)	-	0.1
Trikresylphosphate (TKP)	-	0.1
Isopropylated Triphenylphosphate (ITP)	-	1
Resorcin-bis-diphenylphoshate (RDP)	-	1
Bisphenol-A-bis(diphenylphosphate) (BDP)	-	1

2.2.5 AOX /EOX

Test method: Detection of organic halogenated compounds OHCs: Coulometry following DIN 38414-S18 for AOX – Adsorbable organic halides and following DIN 38414-S17 for EOX – Extractable organic halides following DIN 1485.

Substanz	Messwert [mg/kg]	Berichtsgrenze [mg/kg]
AOX	-	10
EOX	-	1

Evaluation:

No biocides, organic halogenated compounds, pyrethroids or phthalates in measurable concentrations could be detected in the boards submitted for testing. All measurements are below the detection limits specific to the analysis.

2.3 Solvent and odoriferous VOC substance testing

With an increasing presence of chemical substances at our workplaces and in everyday life, the ambient air quality in indoor environment has deteriorated continually. For workplaces, TLV values (threshold limit values) reflecting the concentration of harmful substances have been defined. For habitable rooms, however, where people spend much more time, there are still no legally stipulated maximum quantities or limit values for harmful substances in the indoor air. It is the declared objective of the new federal building codes in Germany and the European Construction Products Directive to protect the health of building users. The corresponding board which is responsible for finding and establishing VOC limit values is called ECA (European Collaborative Action). As early as in 1997, this board rec-

Description	Boiling Range
1. Very Volatile Organic Compound (VVOC)	< 0 to 50...100 °C
2. Volatile Organic Compound (VOC)	50...100 to 240...260 °C
3. Semi Volatile Organic Compound (SVOC)	240...260 to 380...400 °C
4. Organic compound associated with particulate matter or particulate organic matter (POM)	380 °C

ommended the use of the so-called LCI (Lowest Concentration of Interest) as an evaluation scheme, i.e. concentrations that are just of interest from a toxicological point of view. With the exception of pesticides, volatile organic substances were classified according to the WHO definitions with respect to their boiling ranges or the volatility resulting from it. The tested materials all have boiling points, which fall into the range shown below.

Test method: The tests are conducted by means of VOC emission chamber measurement according to DIN EN ISO 16000-9 and CEN/TC 351. The air exchange rate was adapted to the surface size of the test body. The following test parameters were selected:

Chamber Volume	Loading Factor	Air Exchange Rate	Surface of Test Device	Air Temperature	Relative Humidity
0.1 m^3	1.25 m^2/m^3	0.5/h ± 3 %	0.125 m^2	23 ± 1 °C	50 ± 3 %

Volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOC) were concentrated by adsorbing them to activated charcoal. After three, seven and 28 days, the VOCs were isolated by gas chromatography following carbon disulphide-mediated desorption. The VOCs were then identified using mass spectrometry. The individual substances were either quantified against an external toluene standard or quantified substance-specifically by mass spectrometry.

Evaluation according to AgBB scheme:

Test results after 7 days:

Parameter	Measured value	AgBB-requirement
TVOC C_6 to C_{16}	0.001 mg/m³	≤ 0.5 mg/m³
∑ SVOC C_{16} to C_{22}	< 0.001 mg/m³	≤ 0.05 mg/m³
R of ∑ R_i	0.000	≤ 0.5
∑ VOC without NIK	< 0.001 mg/m³	≤ 0.05 mg/m³
∑ CMR- substances	< 0.001 mg/m³	≤ 0.001 mg/m³
Formaldehyde	< 0.002 mg/m³	≤ 0.06 mg/m³

Evaluation:

Based on the measurement results and the comparison of measures according to the AgBB schema as well as the approval principles of the DIBt, exposure to emissions of volatile organic compounds due to the tested powerpanel is not expected. Using the boards in the interior rooms of buildings is therefore harmless to health in regards to VOC emissions.

2.4 Heavy metals

By determining the metals contained in the building materials, a statement can be made regarding health risks and possible environmental hazards of the base products used. The most notorious environmentally harmful heavy metals are lead, cadmium and mercury.

Test method: Quantitative determination according to DIN EN ISO 17294-2 using ICP-MS (inductively coupled plasma mass spectrometry). This method enables detection of a large number of elements in a short time and, due to its capability to detect elements reliably, it is one of the most common methods of trace element analytics.

The limit values according to LAGA (working group of the German federal states on waste issues) are used to identify a possible environmental impact due to heavy metals. The assignment values Z 0 to Z 2 are the upper limits for each incorporation class when ground material is used for earthworks, road building, landscaping and landfill work (e.g. cap layers), for the filling of building pits and for land reclamation.

Z 0: Unrestricted incorporation

Z 1.1: Restricted incorporation in open sites

Z 1.2: Restricted incorporation in open sites in areas with favourable hydrogeological conditions

Z 2: Restricted incorporation with defined technical safety measures

By determining the content in the eluate according to DIN 38414 S 4, a potential hazard to waters caused by metals should be excluded when the material is landfilled after its useful product life. The comparative values according to LAGA are used here as well (eluate assignment values for soil are applicable) and the requirements of the TVO (German Drinking Water Regulation) as of 1 January 2008 are taken into account.

2.4.1 Determination of the original substance

Metals (element symbol)	Mesured value [mg/kg]	Assignement values upper limits [mg/kg]				Limit value IBR [mg/kg]
		Z 0	Z 1.1	Z 1.2	Z 2	
Arsenic (As)	18	20	30	50	150	-
Cadmium (Cd)	0,2	0.6	1	3	10	-
Cobalt (Co)	12	-	-	-	-	200
Chromium (Cr)	54	50	100	200	600	-
Copper (Cu)	95	40	100	200	600	-
Iron (Fe)	13000	-	-	-	-	-
Mercury (Hg)	< 0.5	0.3	1	3	10	-
Manganese (Mn)	390	-	-	-	-	-
Nickel (Ni)	35	40	100	200	600	-
Lead (Pb)	40	100	200	300	1000	-
Antimony (Sb)	5	-	-	-	-	200
Tin (Sn)	30	-	-	-	-	200
Zinc (Zn)	170	120	300	500	1500	-

2.4.2 Determination of the eluate

Metals (element symbol)	Measured value [mg/l]	Assignement values upper limits [mg/l]					Limit value IBR [mg/l]
		Z 0	Z 1.1	Z 1.2	Z 2	TVO	
Arsenic (As)	< 0.005	0.01	0.01	0.04	0.06	0.01	-
Cadmium (Cd)	< 0.001	0.002	0,.002	0.005	0.01	0.003	-
Cobalt (Co)	< 0.002	-	-	-	-	-	0.1
Chromium (Cr)	0.055	0.015	0,03	0.075	0.15	0.05	-
Copper (Cu)	< 0.005	0.05	0.05	0.15	0.3	2	-
Iron (Fe)	< 0.1	-	-	-	-	0.2	-
Mercury (Hg)	< 0.001	0.0002	0.0002	0.001	0.002	0.001	-
Manganese (Mn)	< 0.005	-	-	-	-	0.05	-
Nickel (Ni)	< 0.005	0.04	0.05	0.15	0.2	0.02	-
Lead (Pb)	0.001	0.02	0.04	0.1	0.2	0.01	-
Antimony (Sb)	< 0.001	-	-	-	-	0.005	0.1
Tin (Sn)	< 0.01	-	-	-	-	-	0.1
Zinc (Zn)	< 0.005	0.1	0.1	0.3	0.6	-	

Evaluation:

Based on the measurement values which are below the specified limit values, the boards as building products are not expected to impact the environment.

2.5 Fine dusts

Dusts are defined as dispersed solid particles in gases. Dust dispersion may be caused by mechanical processes or by forces stirring up particles. Like smoke and mist, dusts are aerosols. Aside from the specific damaging effects inherent in the dust particles, the particle concentration, the exposure period and the particle size also influence the assessment of the dust hazard. This distinguishes the assessment of dust hazards from the assessment of gases or steam. The dust is taken up via the respiratory system. The characteristics of particles in streaming gases largely determine the transport and deposition of the dust inside the respiratory tract. The smaller the particle size is the deeper it can penetrate the respiratory tract where it settles and causes health problems. Dust may cause problems from allergic reactions of the mucous membranes to certain cancers of the respiratory tract. For a long time now, limits exist for the dust exposure at work. As a general rule, by comparison with the home environment, the dust exposure at work is considerably more pronounced. On the other hand, people spend considerably more time at home than at work. It is therefore important to also assess whether a product is liable to be the source of fine dust in the living environment of people.

Definition: The largest respirable particles settle in the nose and throat area. Particles that are smaller than 25 µm can move and settle in the tracheobronchial tree. Fibrous particles up to 10

µm in length are able to move as far as the alveoli (tiny air sacs in which the gas exchange takes place in the lungs) providing the diameters of the fibres are less than 3 µm and their densities resemble the densities of minerals. It is this latter portion of the entire dust content, which is assed in the construction biological tests. This portion penetrates all parts of the respiratory tract including the alveoli. While a product may appear to create a lot of dust at first glance, this does not necessary mean that it also contains fine dust, which may move to the alveoli and settle there.

Dependent on the particle size, fine dust is separated into two fractions:

PM 10 (aerodynamic diameter < 10 µm) – defined as 'coarse fraction'
PM 2.5 (aerodynamic diameter < 2.5 µm) – defined as 'fine fraction'

The PM 2.5-fraction is a portion of the PM 10-fraction.

Test Procedure: The fine dust content is determined according to the following standards:

- DIN 53808-1: Determination of the fibre length – individual fibre measurement
- DIN EN ISO 1973: Fineness
- DIN 53811: Determination of the longitudinal fibre diameter in micro-projection
- DIN 53803-2: Practical execution of the sampling
- DIN EN ISO 12341: Air quality – determination of the PM10-fraction

- VDI-Guideline 3866: Determination of asbestos in technical products

Fibre and fine dust determinations always include assaying the fibre length and fibre diameter as well as the statistical assessment of the existing dust mixture. The stream volume determines what measuring device is used, e. g. LVS (Low Volume Sampler), HVS (High Volume Sampler).

In the performed assays, the average fibre length was 1.2 mm.

The average measured diameter of the fibres was 0.03 mm.

Evaluation: The use of the tested product is not expected to pose a fine dust hazard. Neither the traces of dust nor the traces of fine dust were present in the fibrous form, which is prerequisite to the inhalation of dust particles into the alveoli.

3. Overall assessment

Based on the tests that were conducted, the tested powerpanel H_2O of the company Fermacell can be classified as safe in regards to the criteria of the seal of approval guidelines defined by the Institut für Baubiologie Rosenheim GmbH.

Notices on awarding and using the seal of approval

In order to ensure neutrality and impartiality, all tests were carried out by independent third parties. We commission the required studies and tests from economically independent laboratories with which we have been maintaining long-standing business relationships. All test results contained in this expert report have been taken from the external test reports. They are archived and can be viewed by the ordering party at any time. The logo of the seal of approval as shown below is protected by copyright. All rights are owned by the IBR.



This seal of approval must always be used in conjunction with the entire product name. The manufacturer may only use the seal of approval in advertising for the specific products for which it was awarded. The manufacturer is obliged not to try to mislead consumers as to for which products the seal of approval has been awarded and for which not. This also applies to the term "TESTED AND APPROVED BY THE IBR".

The "IBR" mark may only be used as a constituent part of the seal of approval.

It is possible to apply for an extension before the period of validity expires. Continued use of the seal of approval depends on the results from the subsequent tests performed by the IBR. Subsequent testing will always be performed according to the seal of approval guidelines valid at the time of testing.

The manufacturers are obliged to inform the IBR in due time of any modification of the product that might have any impact on the product relevant to building biology.

In case of misuse, the institute may prohibit the use of the seal of approval without notice. Employees of the IBR or persons charged by the IBR may at any time, even without prior notice, visit the applicant's production site.

Rosenheim, 20th of April 2018

Reimut Hentschel | Manager

Dr. Nicole Dannenbauer | Dipl.-Chem.

Bibliography

Within the framework of quality management, we also aim to provide sufficient transparency of our processes to third parties. Among other things, this includes listing all parties involved in the certification process.

Laboratories	Investigations	Address	Internet
Indikator GmbH	Heavy metals content	Kaiserstraße 86 a 42329 Wuppertal/Germany +49 (0)202 2641085	www.indikator-labor.de info@indikator-labor.de
IUT GmbH	Radioactivity	Justus-von-Liebig-Str. 6 D-12489 Berlin-Adlershof +49 (0)30 6392 5511	www.iut-berlin.com info@iut-berlin.com
MPA	VOC/biocides Formaldehyde Fine dusts Building design certificates	Alfred-Möller-Straße 1 D-16225 Eberswalde /Germany +49 (0)33 34 65 560	www.mpawede office@mpaew.de
IUL Vorpommern GmbH	VOC Analysis of pollutants	Am Koppelberg 20 D-17489 Greifswald +49 (0)38 34 57 450	www.iul-vorpommern.de mail@iul-vorpommern.de
Competenza GmbH	Asbestos fine dusts	Flößaustraße 24a D-90763 Fürth +49 (0)911 506880-0	www.competenza.com info@competenza.com
VDE Prüf- und Zertifizierungsinstitut GmbH	VOC/biocides Formaldehyde Fine dusts Building design certificates	Merianstraße 28 D-63069 Offenbach +49 (0)69 8306-0	www.vde.com/de vde-institut@vde.com

All of the aforementioned parties are economically independent companies who provide commercial laboratory analyses in their own name and on their own account.

Assessment of individual compounds:

After 7-days:

CAS-No.	Designation	Ret. area	RT [min]	C [µg/m³]	Identification	Ri	NIK-value
108-87-2	methylcyclohexane	VOC	6.926	1	specific	0.000	8100
50-00-0	formaldehyde	VVOC					100 VVOC