

### 2.2.3 Result of the Formaldehyde Investigation

Table 2.2.1: Result of the Formaldehyde Investigation

Sample description - Description of the variation	Surface-related emission of formaldehyde at 90°C test chamber temperature [mg m <sup>-2</sup> h <sup>-1</sup> ]			Comments
	Test specimen 1	Test specimen 2	Mean value <sup>a</sup> (assessment value)	
"GRABNER-SAUNABOARD" Arolla Pine	<b>0.38</b>	<b>0.39</b>	<b>0.39</b>	-
"GRABNER-SAUNABOARD" Western Red Cedar	<b>0.37</b>	<b>0.38</b>	<b>0.38</b>	-
"GRABNER-SAUNABOARD" Hemlock	<b>0.33</b>	<b>0.34</b>	<b>0.34</b>	-
"GRABNER-SAUNABOARD" American Nut	<b>0.27</b>	<b>0.22</b>	<b>0.24</b>	-
"GRABNER-SAUNABOARD" Acacia	<b>0.35</b>	<b>0.40</b>	<b>0.37</b>	-
"GRABNER-SAUNABOARD" Birch	<b>0.34</b>	<b>0.34</b>	<b>0.34</b>	-
"GRABNER-SAUNABOARD" Spruce	<b>0.29</b>	<b>0.27</b>	<b>0.28</b>	-

<sup>a</sup> Arithmetic mean value rounded up to two significant digits

### 3 EXPERT OPINION

#### 3.1 Assessment Bases for the Investigation of Material Samples for the Emission of Formaldehyde

According to ÖNORM M 6219-1 <sup>1</sup>, which defines the requirements on public and commercial sauna installations, infrared cabins, steam- and other heat chambers, in sauna chambers only solid timbers and layered wood materials may be used, that have a maximum gas analysis value of  $0.4 \text{ mg m}^{-2} \text{ h}^{-1}$  formaldehyde according to ÖNORM EN 717-2 (deviating from the ÖNORM, tested at  $90^\circ\text{C}$ ).

#### 3.2 Assessment Bases for Isocyanates in Wood Samples

There are no known guide values for the emission of isocyanates. If the value is less than the determination limit, it is to be assumed, that the emission is to be regarded as low.

#### 3.3 Assessment Bases for Biocides in Wood Samples

The concentration of pentachlorophenol (PCP) in finished products, that also means in building materials, that are brought into circulation, is restricted by law to  $5 \text{ mg/kg}$  (ppm) <sup>2</sup>. For wood up to  $1 \text{ mg/kg}$  can be assumed as basic load. Values up to  $1 \text{ mg}$  substance/kg indicate a very low load. With values up to  $5 \text{ mg/kg}$  the load is moderate, with values between  $5 - 50 \text{ mg/kg}$  the load is considerable. Values between  $50 - 500 \text{ mg/kg}$  are regarded as high and values above  $500 \text{ mg/kg}$  are regarded as very high.

If there are no concentration values for PCP in sedimented dust available, the German PCP-directive <sup>3</sup>, requires that the PCP-concentrations in possibly treated wood is investigated in further investigations. For this material samples are to be taken from a depth of  $0$  to  $2 \text{ mm}$  of the wood in question. If these result in PCP concentrations of over  $50 \text{ mg PCP/kg}$  wood, in addition to this it is recommended to determine whether the surface area of the treated wood that is in contact with interior air is greater than  $0.2 \text{ m}^2$  per  $\text{m}^3$  in relation to the room volume. If this is also the case, i.e. both values mentioned are exceeded, it is recommended to determine whether the expected annual average room air load is above  $1 \text{ } \mu\text{g PCP/m}^3$  air. If this is the case, then it is recommended in the following, to carry out a renovation of the PCP-burdened room.

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<sup>1</sup> ÖNORM M 6219-1 (2010): Requirements on public and commercial sauna installations, infrared cabins, steam- and other heat chambers Part 1: Planning and operation of saunas and saunas in combination with infrared heat sources - 2010 03 01

<sup>2</sup> PCP-Regulation (1991): Regulation of the Federal Minister for Environment, Youth and Family concerning the ban on Pentachlorophenol (PCP) dated 5.2.1991

<sup>3</sup> PCP-Directive (1996): Directive on the assessment and renovation of Pentachlorophenol (PCP)-burdened building materials and components in buildings. Published by the project group »Pollutants« of the German specialist committee for construction standardization of the working group of the national ministers responsible for the building industry, housing and settlements (ARGEBAU)

### 3.4 Summarized Assessment

With the assessment values of 0.24 to 0.39 mg m<sup>-2</sup> h<sup>-1</sup>, all seven investigated samples, which differ through different top layers, were below the maximum permitted gas analysis value of 0.4 mg m<sup>-2</sup> h<sup>-1</sup> and are therefore in conformity with the specifications of ÖNORM M 6219-1. The investigated materials are therefore suitable for sauna construction.

In comparison with lower emitting wood types such as hemlock or linden, the wood types cedar and acacia normally have a relatively higher emission of formaldehyde, when they are tested as solid wood sections at 90°C. In the present investigation the materials veneered with these two more strongly emitting wood types are also below the gas analysis value defined in ÖNORM M 6219-1.

No biocides were proven in the investigated mixed samples, which were obtained from seven "GRABNER-SAUNABOARD" base boards. In the test chamber investigations of two selected "GRABNER-SAUNABOARD" boards no emissions of isocyanates above the determination limit were proven.

Based on all available measurement results it can be assumed, that thin layers of veneer on a (relatively low emitting) "GRABNER-SAUNABOARD"-carrier board do not increase the emission of formaldehyde of the investigated woods above the gas analysis value defined in ÖNORM M 6219-1.

Furthermore it can be assumed with the greatest probability, that no significant increase in formaldehyde emission also occurs with other (not tested) wood types due to a veneer and that therefore all "GRABNER-SAUNABOARD"-boards veneered at works are suitable for sauna construction. This statement is only permitted for "GRABNER-SAUNABOARD" boards veneered at works, that are not bonded with any formaldehyde splitting glue.



General Sworn-in and Court  
Certified Appraiser  
Dipl. Ing. Peter Tappler



Project management  
Dipl. Ing. Bernhard Damberger

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### 3 Expert Opinion

#### 3.1 Assessment Bases

According to ÖNORM M 6219-1 <sup>1</sup>, which defines the requirements on public and commercial sauna installations, infrared cabins, steam- and other heat chambers, in sauna chambers only solid timbers and layered wood materials may be used, that have a maximum gas analysis value of  $0.4 \text{ mg m}^{-2} \text{ h}^{-1}$  formaldehyde according to ÖNORM EN 717-2 (deviating from the ÖNORM, tested at  $90^\circ\text{C}$ ).

#### 3.2 Assessment

For the investigated material with the designation "Grabner-Saunaboard Alder/Hemlock", at  $90^\circ\text{C}$  test chamber temperature the gas analysis value was significantly below the value of  $0.4 \text{ mg m}^{-2} \text{ h}^{-1}$  required in ÖNORM M 6219-1 for the formaldehyde emission.



Initial findings

Dipl. Ing. Bernhard Damberger



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<sup>1</sup> ÖNORM M 6219-1 (2010): Requirements on public and commercial sauna installations, infrared cabins, steam- and other heat chambers Part 1: Planning and operation of saunas and saunas in combination with infrared heat sources - 2010 03 01

### 3 Expert Opinion

#### 3.1 Assessment Bases

According to ÖNORM M 6219-1 <sup>1</sup>, which defines the requirements on public and commercial sauna installations, infrared cabins, steam- and other heat chambers, in sauna chambers only solid timbers and layered wood materials may be used, that have a maximum gas analysis value of  $0.4 \text{ mg m}^{-2} \text{ h}^{-1}$  formaldehyde according to ÖNORM EN 717-2 (deviating from the ÖNORM, tested at  $90^\circ\text{C}$ ).

#### 3.2 Assessment

For the investigated material with the designation "GRABNER-SONNBOARD", at  $90^\circ\text{C}$  test chamber temperature the gas analysis value was significantly below the value of  $0.4 \text{ mg m}^{-2} \text{ h}^{-1}$  required in ÖNORM M 6219-1 for the formaldehyde emission.



Initial findings

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<sup>1</sup> ÖNORM M 6219-1 (2010): Requirements on public and commercial sauna installations, infrared cabins, steam- and other heat chambers Part 1: Planning and operation of saunas and saunas in combination with infrared heat sources - 2010 03 01

### 3 Expert Opinion

#### 3.1 Assessment Bases

According to ÖNORM M 6219-1 <sup>1</sup>, which defines the requirements on public and commercial sauna installations, infrared cabins, steam- and other heat chambers, in sauna chambers only solid timbers and layered wood materials may be used, that have a maximum gas analysis value of  $0.4 \text{ mg m}^{-2} \text{ h}^{-1}$  formaldehyde according to ÖNORM EN 717-2 (deviating from the ÖNORM, tested at  $90^\circ\text{C}$ ).

#### 3.2 Assessment

For the investigated material with the designation Grabner-Saunaboard Structure "Oak Altaussee", at  $90^\circ\text{C}$  test chamber temperature the gas analysis value was significantly below the value of  $0.4 \text{ mg m}^{-2} \text{ h}^{-1}$  required in ÖNORM M 6219-1 for the formaldehyde emission.



Initial findings

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<sup>1</sup> ÖNORM M 6219-1 (2010): Requirements on public and commercial sauna installations, infrared cabins, steam- and other heat chambers Part 1: Planning and operation of saunas and saunas in combination with infrared heat sources - 2010 03 01

### 3 Expert Opinion

#### 3.1 Assessment Bases

According to ÖNORM M 6219-1 <sup>1</sup>, which defines the requirements on public and commercial sauna installations, infrared cabins, steam- and other heat chambers, in sauna chambers only solid timbers and layered wood materials may be used, that have a maximum gas analysis value of  $0.4 \text{ mg m}^{-2} \text{ h}^{-1}$  formaldehyde according to ÖNORM EN 717-2 (deviating from the ÖNORM, tested at 90°C).

#### 3.2 Assessment

For the investigated material with the designation Grabner-Saunaboard Structure “Oak Mondsee”, at 90°C test chamber temperature the gas analysis value was below the value of  $0.4 \text{ mg m}^{-2} \text{ h}^{-1}$  required in ÖNORM M 6219-1 for the formaldehyde emission.



Initial findings

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<sup>1</sup> ÖNORM M 6219-1 (2010): Requirements on public and commercial sauna installations, infrared cabins, steam- and other heat chambers Part 1: Planning and operation of saunas and saunas in combination with infrared heat sources - 2010 03 01

### 3 Expert Opinion

#### 3.1 Assessment Bases

According to ÖNORM M 6219-1 <sup>1</sup>, which defines the requirements on public and commercial sauna installations, infrared cabins, steam- and other heat chambers, in sauna chambers only solid timbers and layered wood materials may be used, that have a maximum gas analysis value of  $0.4 \text{ mg m}^{-2} \text{ h}^{-1}$  formaldehyde according to ÖNORM EN 717-2 (deviating from the ÖNORM, tested at  $90^\circ\text{C}$ ).

#### 3.2 Assessment

For the investigated material with the designation "Grabner-Saunaboard – StoneslikeStones", at  $90^\circ\text{C}$  test chamber temperature the gas analysis value was significantly below the value of  $0.4 \text{ mg m}^{-2} \text{ h}^{-1}$  required in ÖNORM M 6219-1 for the formaldehyde emission.

Initial findings

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<sup>1</sup> ÖNORM M 6219-1 (2010): Requirements on public and commercial sauna installations, infrared cabins, steam- and other heat chambers Part 1: Planning and operation of saunas and saunas in combination with infrared heat sources - 2010 03 01



### 3 Expert Opinion

#### 3.1 Evaluation Criteria

According to ÖNORM M 6219-1 <sup>2</sup>, which defines the requirements on public and commercial sauna facilities, infrared cabins, steam- and other heat chambers, in sauna chambers only solid woods and wood layer materials may be used, that have a maximal gas analysis value of 0.4 mg m<sup>-2</sup> h<sup>-1</sup> formaldehyde according to ÖNORM EN ISO 12460-3 (deviating from the ÖNORM, tested at 90°C).

#### 3.2 Assessment

For the investigated material with the designation "Saunaboard Colour", the formaldehyde emission was below the gas analysis value of 0.4 mg m<sup>-2</sup> h<sup>-1</sup> required in ÖNORM M 6219-1 at a test chamber temperature of 90°C. The material is suitable for sauna construction.



Generally sworn and court  
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<sup>2</sup> ÖNORM M 6219-1 (2010): Requirements on public and commercial sauna facilities, infrared cabins, steam- and other heat chambers - Part 1: Planning and operation of saunas and saunas in combination with infrared heat source – 2010 03 01

### 3 Expert Opinion

#### 3.1 Evaluation of the Results

In the above described test chamber conditions, the investigated test specimens "Colour Black – Tulpin Wood" and "Colour Red – Sup Gum" showed an insignificant and material-typical emission of volatile hydrocarbons (VOC). From experience compounds from the classes of aldehydes and the terpenes are emitted from wood and wood materials among others and were therefore to be expected at a test temperature of 90 °C.

The investigation showed no indications of relevant emissions in connection with the colouring agents used. It can be assumed, that even with veneers of a different colour with comparable colouring agents, with great probability no material-atypical emissions will be released by the "JGrabner Saunaboard Colour Kollektion".



Dipl. Ing. Peter Tappler



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## **ANALYSIS OF MATERIAL SAMPLES FOR THE EMISSION OF VOLATILE ORGANIC COMPOUNDS**

### **FINDINGS AND EXPERT REPORT**

Project number: **Y0082**

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## 1 Task definition

Material samples transmitted by the client are to be analyzed for the emission of Volatile Organic Compounds (VOC). The analysis is to be performed at sauna temperatures (90°C).

## 2 Findings

### 2.1 Analysis of material samples for the emission of Volatile Organic Compounds

#### 2.1.1 *Modus operandi* and methodology

The stainless-steel test chamber used for analyzing the emission behavior exhibits a volume of 4.017 liters and is described in Austrian standard ÖNORM EN ISO 12460-3<sup>1</sup>. Temperature control to  $\pm 0.5$  °C is ensured by a liquid jacket enclosing the chamber. The incoming air was cleaned by way of an activated carbon filter.

The material under analysis was introduced in the cylindrical test chamber in such a way so that the tests specimen could be washed around from all sides. At a defined air-exchange rate in the chamber, the air in the test chamber was analyzed for Volatile Organic Compounds. Sampling was performed by way of adsorption of the substances under analysis to activated carbon, with the air volume conducted through the test chamber being guided entirely via an adsorbent [SKC, Anasorb 747].

The chemical analysis was performed in accordance with Austrian standard ÖNORM M 5700-2. The activated carbon was removed from the adsorption tube and eluted with carbon disulfide (CS<sub>2</sub>). The obtained CS<sub>2</sub> extract was directly subjected to quantitative analysis. The individual Volatile Organic Compounds were determined by way of capillary gas chromatography with a coupled mass spectrometer [Shimadzu QP-2010S] by using a capillary column [HP-VOC HEWLETT PACKARD, 50 m] with regard to external and internal standards. The signals obtained from the detector were recorded electronically, with the quantification carried out via the peak surfaces. Measurement inaccuracy is estimated at  $\pm 20$  %.

#### 2.1.2 Calculation of surface-related emission

The measured equilibrium concentration in the test chamber was related to the volume of the supplied air, the sampling time, and the surface of the test item. On this basis, the surface-based emission of volatile substances was calculated in micrograms per square meter and hour [ $\mu\text{g m}^{-2} \text{h}^{-1}$ ].

Note: Measurements carried out using the above-described test apparatus result in measured values describing the source strengths of emitting substances under certain boundary conditions

<sup>1</sup> ÖNORM EN ISO 12460-3 (2015): Wood-based panels – Determination of formaldehyde release - Part 3: Gas analysis method (ISO/DIS 12460-3: 2015)

that are exactly defined. Yet the rate of emissions released by a material under practical conditions is impacted by a wide range of factors and may deviate from the indicated values.

### 2.1.3 Description of samples for the analysis of the emission of Volatile Organic Compounds

The client supplied veneers bearing the designations “Colour Black – Tulpin Wood” and “Colour Red – Sup Gum”. The emission behavior exhibited by the test specimens was tested after a respective conditioning phase of 3 hours in the preheated test chamber. The test chamber had been flushed with purified air before.

Table 2.1.1: Data from the material analysis for Volatile Organic Compounds



	Unit	Data	Image
Sample source		Supplied by the client	
Material description		Colour Black – Tulip Wood	
Date of sample receipt		28 Jan 2020	
Date of analysis		05 Feb 2020	
Start of sampling	[hh.mm]	12:50	
End of sampling	[hh.mm]	13:57	
Surface-related air flow rate	[m³/m²h]	0.91	
Test chamber temperature	[°C]	90	

Table 2.1.2: Data from the material analysis for Volatile Organic Compounds

	Unit	Data	Image
Sample source		Supplied by the client	
Material description		Colour Red – Sup Gum	
Date of sample receipt		28 Jan 2020	
Date of analysis		21 Feb 2020	
Start of sampling	[hh.mm]	13:00	
End of sampling	[hh.mm]	13:40	
Surface-related air flow rate	[m³/m²h]	0.67	
Test chamber temperature	[°C]	90	



## 2.1.4 Results of the analysis of the emission of Volatile Organic Compounds (VOC)

Table 2.1.3: Results of the emission analysis for Volatile Organic Compounds, surface-related emission indicated in  $\mu\text{g}/\text{m}^2 \text{ h}^a$

Sample identification		Colour Black – Tulip Wood	
Date of analysis		05 Feb 2020	
Substance	Unit	Conc.	LOD
<b>Aliphatic and alicyclic compounds</b>			
n-heptane	$[\mu\text{g}/\text{m}^2\text{h}]$	n.d.	3
n-octane	$[\mu\text{g}/\text{m}^2\text{h}]$	n.d.	3
n-nonane	$[\mu\text{g}/\text{m}^2\text{h}]$	n.d.	3
n-decane	$[\mu\text{g}/\text{m}^2\text{h}]$	n.d.	4
n-undecane	$[\mu\text{g}/\text{m}^2\text{h}]$	n.d.	4
n-dodecane	$[\mu\text{g}/\text{m}^2\text{h}]$	n.d.	4
n-tridecane	$[\mu\text{g}/\text{m}^2\text{h}]$	n.d.	4
n-tetradecane	$[\mu\text{g}/\text{m}^2\text{h}]$	n.d.	4
n-pentadecane	$[\mu\text{g}/\text{m}^2\text{h}]$	n.d.	4
n-hexadecane	$[\mu\text{g}/\text{m}^2\text{h}]$	n.d.	4
Cyclohexane	$[\mu\text{g}/\text{m}^2\text{h}]$	n.d.	3
Methylcyclohexane	$[\mu\text{g}/\text{m}^2\text{h}]$	n.d.	3
2,2,4,6,6-pentamethylheptane	$[\mu\text{g}/\text{m}^2\text{h}]$	n.d.	5
Trimeric isobutene I + II	$[\mu\text{g}/\text{m}^2\text{h}]$	n.d.	5
4-phenylcyclohexene	$[\mu\text{g}/\text{m}^2\text{h}]$	n.d.	5
<b>Aromatic compounds</b>			
Benzene	$[\mu\text{g}/\text{m}^2\text{h}]$	n.d.	3
Toluene	$[\mu\text{g}/\text{m}^2\text{h}]$	n.d.	2
Ethylbenzene	$[\mu\text{g}/\text{m}^2\text{h}]$	n.d.	3
m,p-xylene	$[\mu\text{g}/\text{m}^2\text{h}]$	n.d.	3
o-xylene	$[\mu\text{g}/\text{m}^2\text{h}]$	n.d.	4
Styrene	$[\mu\text{g}/\text{m}^2\text{h}]$	n.d.	3
Propylbenzene	$[\mu\text{g}/\text{m}^2\text{h}]$	n.d.	3
3-ethyltoluene	$[\mu\text{g}/\text{m}^2\text{h}]$	n.d.	4
2-ethyltoluene	$[\mu\text{g}/\text{m}^2\text{h}]$	n.d.	4
1,3,5-trimethylbenzene	$[\mu\text{g}/\text{m}^2\text{h}]$	n.d.	5
1,2,4-trimethylbenzene	$[\mu\text{g}/\text{m}^2\text{h}]$	n.d.	5
1,2,3-trimethylbenzene	$[\mu\text{g}/\text{m}^2\text{h}]$	n.d.	4
<b>Chlorinated substances</b>			
Tetrachloroethene (PER)	$[\mu\text{g}/\text{m}^2\text{h}]$	n.d.	12
Chlorobenzene	$[\mu\text{g}/\text{m}^2\text{h}]$	n.d.	4

Substance	Unit	Conc.	LOD
<b>Ester</b>			
Ethylacetate	$[\mu\text{g}/\text{m}^2\text{h}]$	n.d.	3
iso-propylacetate	$[\mu\text{g}/\text{m}^2\text{h}]$	n.d.	3
iso-butylacetate	$[\mu\text{g}/\text{m}^2\text{h}]$	n.d.	3
n-butylacetate	$[\mu\text{g}/\text{m}^2\text{h}]$	n.d.	3
1-methoxy-2-propylacetate (MPA)	$[\mu\text{g}/\text{m}^2\text{h}]$	n.d.	4
Texanoldiisobutyrate (TXIB)	$[\mu\text{g}/\text{m}^2\text{h}]$	n.d.	5
<b>Aldehydes</b>			
Pentanal	$[\mu\text{g}/\text{m}^2\text{h}]$	n.d.	4
Hexanal	$[\mu\text{g}/\text{m}^2\text{h}]$	9	6
Heptanal	$[\mu\text{g}/\text{m}^2\text{h}]$	7	6
Octanal	$[\mu\text{g}/\text{m}^2\text{h}]$	8	6
Nonanal	$[\mu\text{g}/\text{m}^2\text{h}]$	16	6
Decanal	$[\mu\text{g}/\text{m}^2\text{h}]$	8	6
<b>Ketones</b>			
4-methyl-2-pentanone (MIBK)	$[\mu\text{g}/\text{m}^2\text{h}]$	n.d.	3
Cyclohexanone	$[\mu\text{g}/\text{m}^2\text{h}]$	n.d.	5
Acetophenone	$[\mu\text{g}/\text{m}^2\text{h}]$	n.d.	6
Benzophenone	$[\mu\text{g}/\text{m}^2\text{h}]$	n.d.	6
<b>Terpenes</b>			
Alpha-pinene	$[\mu\text{g}/\text{m}^2\text{h}]$	4	4
Beta-pinene	$[\mu\text{g}/\text{m}^2\text{h}]$	n.d.	5
3-carene	$[\mu\text{g}/\text{m}^2\text{h}]$	n.d.	5
Limonene	$[\mu\text{g}/\text{m}^2\text{h}]$	14	4
<b>Other</b>			
Octamethyltetracyclosiloxane	$[\mu\text{g}/\text{m}^2\text{h}]$	n.d.	5
Decamethylpentacyclosiloxane	$[\mu\text{g}/\text{m}^2\text{h}]$	n.d.	5
<b>Sum VOC ident.</b>	<b><math>[\mu\text{g}/\text{m}^2\text{h}]</math></b>	<b>66</b>	

<sup>a</sup>  $\mu\text{g}/\text{m}^2 \text{ h}$  = microgram per square meter and hour ( $\mu\text{g m}^{-2} \text{ h}^{-1}$ )  
n.d. = below Limit of Determination, na = not evaluable,

LOD = Limit of Determination

The “SUM VOC ident.” parameter designates the sum of identified individual compounds.

Sample identification	Colour Red – Sup Gum		
Date of analysis	21 Feb 2020		
Substance	Unit	Conc	LOD
<b>Aliphatic and alicyclic compounds</b>			
n-heptane	[µg/m²h]	n.d.	3
n-octane	[µg/m²h]	n.d.	3
n-nonane	[µg/m²h]	n.d.	3
n-decane	[µg/m²h]	n.d.	3
n-undecane	[µg/m²h]	n.d.	4
n-dodecane	[µg/m²h]	n.d.	4
n-tridecan	[µg/m²h]	n.d.	4
n-tetradecane	[µg/m²h]	n.d.	4
n-pentadecane	[µg/m²h]	n.d.	4
n-hexadecane	[µg/m²h]	n.d.	4
Cyclohexane	[µg/m²h]	n.d.	3
Methylcyclohexane	[µg/m²h]	n.d.	2
2.2.4.6.6-pentamethylheptane	[µg/m²h]	n.d.	5
Trimeric isobutene I + II	[µg/m²h]	n.d.	5
4-phenylcyclohexene	[µg/m²h]	n.d.	5
<b>Aromatic compounds</b>			
Benzene	[µg/m²h]	n.d.	3
Toluene	[µg/m²h]	n.d.	2
Ethylbenzene	[µg/m²h]	n.d.	3
m,p-xylene	[µg/m²h]	n.d.	3
o-xylene	[µg/m²h]	n.d.	4
Styrene	[µg/m²h]	n.d.	3
Propylbenzene	[µg/m²h]	n.d.	3
3-ethyltoluene	[µg/m²h]	n.d.	4
2-ethyltoluene	[µg/m²h]	n.d.	4
1,3,5-trimethylbenzene	[µg/m²h]	n.d.	5
1,2,4-trimethylbenzene	[µg/m²h]	n.d.	5
1,2,3-trimethylbenzene	[µg/m²h]	n.d.	4
<b>Chlorinated substances</b>			
Tetrachloroethene (PER)	[µg/m²h]	n.d.	12
Chlorobenzene	[µg/m²h]	n.d.	4

Substance	Unit	Conc .	LOD
<b>Ester</b>			
Ethylacetate	[µg/m²h]	n.d.	3
iso-propylacetate	[µg/m²h]	n.d.	3
iso-butylacetate	[µg/m²h]	n.d.	3
n-butylacetate	[µg/m²h]	n.d.	3
1-methoxy-2-propylacetate (MPA)	[µg/m²h]	n.d.	4
Texanoldiisobutyrate (TXIB)	[µg/m²h]	n.d.	5
<b>Aldehydes</b>			
Pentanal	[µg/m²h]	n.d.	4
Hexanal	[µg/m²h]	52	6
Heptanal	[µg/m²h]	13	6
Octanal	[µg/m²h]	17	5
Nonanal	[µg/m²h]	18	6
Decanal	[µg/m²h]	11	6
<b>Ketones</b>			
4-Methyl-2-pentanone (MIBK)	[µg/m²h]	n.d.	3
Cyclohexanone	[µg/m²h]	n.d.	5
Acetophenone	[µg/m²h]	n.d.	6
Benzophenone	[µg/m²h]	n.d.	6
<b>Terpenes</b>			
Alpha-pinene	[µg/m²h]	n.d.	4
Beta-pinene	[µg/m²h]	n.d.	5
3-carene	[µg/m²h]	n.d.	5
Limonene	[µg/m²h]	4	4
<b>Other</b>			
Octamethyltetra-cyclosiloxane	[µg/m²h]	n.d.	5
Decamethylpentacyclosiloxane	[µg/m²h]	n.d.	5
<b>Sum VOC ident.</b>	<b>[µg/m²h]</b>	<b>120</b>	

LOD = Limit of Determination

The “SUM VOC ident.” parameter designates the sum of identified individual compounds.



### 3 Expert report

#### 3.1 Evaluation of results

The analyzed test specimens “Colour Black – Tulpin Wood” and “Colour Red – Sup Gum” exhibited a release of volatile organic compounds (VOC) under the test-chamber conditions described above that is inconspicuous and typical of the material. According to experience, compounds falling within the classes of aldehydes and terpenes are released, *inter alia*, by wood and wood-based materials and were thus to be expected at a test temperature of 90 °C.

The analysis did not show any indications of relevant emissions related to the colorants used. It can be assumed in all probability that, also with regard to other colored veneers for which comparable colorants of the “JGrabner Saunaboard Colour Collection” were used, no emissions are released that are atypical of the material.



Certified Engineer Peter Tappler

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### 3 Expert Opinion

#### 3.1 Evaluation Criteria

According to ÖNORM M 6219-1 <sup>2</sup>, which defines the requirements on public and commercial sauna facilities, infrared cabins, steam- and other heat chambers, in sauna chambers only solid woods and wood layer materials may be used, that have a maximal gas analysis value of  $0.4 \text{ mg m}^{-2} \text{ h}^{-1}$  formaldehyde according to ÖNORM EN ISO 12460-3 (deviating from the ÖNORM, tested at  $90^\circ\text{C}$ ).

#### 3.2 Assessment

For the investigated materials with the designations "black MDF board" and "Birch plywood board", the gas analysis value of  $0.4 \text{ mg m}^{-2} \text{ h}^{-1}$  for the formaldehyde emission required in ÖNORM M 6219-1 was exceeded significantly at a test chamber temperature of  $90^\circ\text{C}$ . It is to be expected, that the use of the material in a sauna chamber would lead to an increased concentration of formaldehyde in the room air.



Generally sworn and court  
certified expert  
Dipl. Ing. Peter Tappler



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2 ÖNORM M 6219-1 (2016): Requirements on public and commercial sauna facilities, infrared cabins, steam- and other heat chambers - Part 1: Sauna and sauna in combination with infrared heat sources and sauna chamber with controlled humidity – 2016 11 01.

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## **TEST CHAMBER EXAMINATIONS OF A MATERIAL SAMPLE FOR FORMALDEHYDE**

**SAUNABOARD: GABOON MIX/HEMLOCK**

## **FINDINGS AND EXPERT REPORT**

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Project number: **A3560**

Client: **J Grabner GmbH**  
Peter-Mitterbauer-Straße 2  
4661 Roitham

Sample origin: Peter-Mitterbauer-Straße 2  
4661 Roitham

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## 1 Task Definition

Based on Austrian standard ÖNORM EN ISO 12460-3 <sup>1</sup>, a sample is to be tested for formaldehyde emission at a test chamber temperature of 90°C.


## 2 Findings

### 2.1 Examination of material samples for emission of formaldehyde

#### 2.1.1 Description of samples

The client sent 5 pces. of test specimens of wood material samples labeled with „Saunaboard Gaboon Mix/Hemlock“ showing dimensions of 400 x 50 mm per post. Two test specimens were examined.

Table 2.1.1 Description of sample

Sample name according to client	Date of sample receipt	Figure
Saunaboard Gaboon Mix/Hemlock	01.07.2022	

#### 2.1.2 Procedure and methodology

The stainless-steel test chamber used for testing the emission characteristics features a volume of 4 litres and is described in Austrian standard ÖNORM EN ISO 12460-3. Temperature control to  $\pm 0.5$  °C was performed by way of a liquid jacket surrounding the chamber. Formaldehyde emission was determined as described in ÖNORM EN ISO 12460-3, at a test-chamber temperature of 90° C, in deviation from the ÖNORM. The air brought into the test chamber was purified and dehumidified. The test specimens subject to testing were introduced in the cylindrical test chamber in a way to allow their being surrounded by air on all sides. At a defined air-change rate in the chamber, the exhaust air from the test chamber was tested for formaldehyde. Collection of the formaldehyde was performed by way of absorption of the aldehyde in water, with a predefined air volume flowing through a gas sampling device (acetyl acetone method described in ÖNORM EN ISO 12460-3). The analytical determination of the formaldehyde was performed via

<sup>1</sup> ÖNORM EN ISO 12460-3-Wood-based panels - Determination of formaldehyde release - Part 3: Gas analysis method (ISO/DIS 12460-3:2013)

pentane-2,4-dione (acetyl acetone), with the formaldehyde reacting with pentane-2,4-dione in the presence of ammonium acetate and acetic acid by forming 3,5-diacetyl-1,4-dihydrolutidine. The absorption of the colorant formed in the process, its colour intensity being proportional to the formaldehyde concentration in the sample, was measured by way of a spectrophotometer at a wave length of 412 nm.

### 2.1.3 Calculation of spatial emission

The equilibrium concentration measured in the test chamber was correlated with the volume of the added air, the sampling time and the surface of the tested item. On this basis, the spatial formaldehyde emission (gas analysis value), expressed in milligrams per square meter and hour [ $\text{mg m}^{-2} \text{h}^{-1}$ ], was calculated. The detection limit was at  $0.1 \text{ mg m}^{-2} \text{h}^{-1}$ . On the basis of the test results achieved for two test specimens made from the same sample material, the arithmetic mean was calculated (assessment value).

Note: measurements performed in the test equipment described above resulted in measured values of the emission rates of emitting substances under certain exactly defined framework conditions. The emission rate of a given material under real-life conditions is, however, impacted by a multitude of factors, and may deviate from the given values.

### 2.1.4 Result of formaldehyde testing

Table 2.1.2: Result of formaldehyde testing

Sample name	Spatial formaldehyde emission at 90°C test chamber temperature [ $\text{mg m}^{-2} \text{h}^{-1}$ ]			Notes
	Test specimen 1	Test specimen 2	Mean value <sup>a</sup> (assessment value)	
Saunaboard Gaboon Mix/Hemlock	0.41	0.39	<b>0.4</b>	–

<sup>a</sup> Arithmetic mean value rounded to a significant figure

### 3 Expert report

#### 3.1 Basis of assessment

According to ÖNORM M 6219-1<sup>2</sup>, establishing the requirements for public and commercial sauna facilities, infrared cabins, steam and other warm chambers, only solid woods and wood layer materials may be used in sauna chambers which feature a maximum gas analysis value of  $0.4 \text{ mg m}^{-2} \text{ h}^{-1}$  of formaldehyde according to ÖNORM EN ISO 12460-3 (tested at 90 °C, in deviation from the ÖNORM).

#### 3.2 Assessment

For the material examined labeled as „Saunaboard Gaboon Mix/Hemlock“ the gas analysis value of  $0.4 \text{ mg m}^{-2} \text{ h}^{-1}$  required in ÖNORM M 6219-1 for formaldehyde emission at a test chamber temperature of 90°C was not exceeded. The tested workpieces therefore meet the requirements of ÖNORM M 6219-1.



Dipl. Ing. Peter Tappler

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<sup>2</sup> ÖNORM M 6219-1 (2016): Requirements for public and commercial sauna installations, infrared cabins, steam and other warm chambers - Part 1: Sauna and sauna in combination with infrared thermal sources and sauna chamber with controlled air humidity – 2016 11 01