



Produktprüfung
Zertifizierung
Qualitätssicherung

eco
INSTITUT



Natural Latex Foam Mattress Core

Richard Pieris & Co Ltd, Sri Lanka

Test Report Nr. 17984



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Test Report No. 17984

Client:	Richard Pieris & Co Ltd, Sri Lanka
Sample marking by client:	Natural Latex Foam Mattress Core
Sample No.:	17984
Type of sample:	Natural Latex Foam Mattress Core
Sampled by:	Dr. Shantha Walpalesi, Department of Chemical + Process Engineering, University of Moratnau, Sri Lanka
Sample on (date):	3 January 2008
Location of sampling:	Manufacturing location
Production date:	2 January 2008 (current production)
Sample received:	10 January 2008
Date of report creation:	4 March 2008
Number of pages of the report:	21
Test aims:	See table of contents
Testing laboratory:	eco-INSTITUT, Cologne



Product testing Certification Quality assurance'
 Latex mattresses • Undyed textile coverings

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Test report

Complete mattress

1 Emissions analysis

1.1 Volatile organic compounds (VOC)

Definition of terms:

VOC (volatile organic compounds)	All individual materials with a concentration ≥ 0.001 mg/m ³ in retention range C ₆ (n-Hexane) to C ₁₆ (n-Hexadecane) Substances refer to NIK lists / AgBB (DIBt) Sum of all individual substances in retention range C ₆ to C ₁₆ .
TVOC (total volatile organic compounds) CMR VOC (carcenogenic, mutagenic, reproduction toxic VOC)	All individual substances with the following categories: Directive 67/548 EC: Carc. Cat.1, 2; Mut. Cat.1, 2; Repr. Cat.1, 2 IARC: Group 1, 2A DFG (MAK lists): Category III1, III2
VVOC (lightly volatile organic compounds)	All individual substances with concentration ≥ 0.001 mg/m ³ in retention range $< C_6$
SVOC (semi-volatile organic compounds)	All individual materials ≥ 0.001 mg/m ³ in retention range $> C_{16}$ (n-Hexadecane) to C ₂₂ (Docosane)
Total SVOC (total semi-volatile organic compounds)	Sum of all SVOC in retention range $> C_{16}$ to C ₂₂ .
Identified and calibrated and substances (C _{id sub}), substance specific calculated	Spectrum and retention time are concordant with the calibrated comparison substance
Not identified substances calculated as toluene equivalent (C _{ni tol})	Suggestion from the spectrum library with high probability and/or allocation to a group of substances
SER	Specific emission rate (see appendix)



List of the analysed VOCs:

Aromatic hydrocarbons

Toluene
Ethylbenzene
p-Xylene
m-Xylene
o-Xylene
Isopropylbenzene
n-Propylbenzene
1,3,5-Trimethylbenzene
1,2,4-Trimethylbenzene
1,2,3-Trimethylbenzene
2-Ethyltoluene
1-Isopropyl-4-methylbenzene
1,2,4,5-Tetramethylbenzene
n-Butylbenzene
1,3-Diisopropylbenzene
1,4-Diisopropylbenzene
Phenyl octane
1-Phenyl decane**
1-Phenyl undecane**
4-Phenylcyclohexene
Styrene
Phenyl acetylene
2-Phenyl propene
Vinyl toluene
Naphthalene
Indene
Benzene

Saturated aliphatic substances

Hydrocarbons

2-Methyl pentane*

3-Methyl pentane*
n-Hexane
Cyclohexane
Methylcyclohexane
1,4-Dimethylcyclohexane
n-Heptane
n-Octane
n-Nonane
n-Decane
n-Undecane
n-Dodecane
n-Tridecane
n-Tetradecane
n-Pentadecane
n-Hexadecane
Methylcyclopentane

Terpenes

δ-3-Carene
α-Pinene
β-Pinene
Limonene

Aliphatic alcohols and ether

1-Propanol*
2-Propanol*
tert-Butanol
2-Methyl-1-propanol
1-Butanol
1-Pentanol
1-Hexanol
Cyclohexanol
2-Ethyl-1-hexanol
1-Octanol
4-Hydroxy-4-methyl-pentan-2-one
1-Heptanol
1-Nonanol
1-Decanol

Aromatic alcohols (phenols)

Phenol
BHT (2,6-di-tert-butyl-4-methylphenol)
Benzylalcohol

Glycols, Glycol ether, Glycol ester

Propylenglycol (1,2-Dihydroxypropane)
Ethylene glycol (Ethandiol)
Ethylene glycol monobutyl ether
Diethylene glycol
Diethylene glycol-monobutyl ether
2-Phenoxyethanol
Ethylene carbonate
1-Methoxy-2-propanol
Glycolic acid butyl ester
Butyldiglycol acetate
Dipropylenglycol mono-methyl ether
2-Methoxyethanol
2-Ethoxyethanol
2-Propoxyethanol
2-Methylethoxyethanol
2-Hexoxyethanol
1,2-Dimethoxyethane
1,2-Diethoxyethane
2-Methoxyethyl acetate
2-Ethoxyethyl acetate
2-Butoxyethyl acetate
2-(2-Hexoxyethoxy)-ethanol
1-Methoxy-2-(2-methoxy-ethoxy)-ethane
Propylene glycol di-acetate
Dipropylene glycol
Dipropylene glycol monomethylether acetate
Dipropylene glycol mono-n-propylether
Dipropylene glycol mono-t-butylether
1,4-Butanediol
Tripropyleneglycolmonomethyl ether
Triethylene glycol dimethyl ether
1,2-Propylene glycol dimethyl ether

Aldehyde

Butanal*
Pentanal
Hexanal
Heptanal
2-Ethylhexanal
Octanal
Nonanal
Decanal
2-Butenal
2-Pentenal
2-Hexenal
2-Heptenal
2-Octenal
2-Nonenal
2-Decenal
2-Undecenal
Furfural
Glutaraldehyde
Benzaldehyde

Ketones

Ethylmethylketone
3-Methyl-2-propanol
Methylisobutylketone
Cyclopentanone
Cyclohexanone
2-Methylcyclopentanone
2-Methylcyclohexanone
Acetophenone
1-Hydroxyacetone

Acids

Acetic acid
Propionic acid
Isobutyric acid
Butyric acid
Pivalic acid
n-Valeric acid
n-hexanoic acid
n-Heptanoic acid
n-Octanoic acid
2-Ethylhexanoic acid

Esters and Lactones

Methylacetate*
Ethyl acetate*
Vinyl acetate*
Isopropyl acetate
Propyl acetate
2-Methoxy-1-methylethyl acetate
n-Butyl formate
Methylmethacrylate
Isobutylacetate
1-Butyl acetate
2-Ethylhexyl acetate
Methyl acrylate
Ethyl acrylate
n-Butyl acrylate
2-Ethylhexyl acrylate
Adipic acid dimethyl ester
Fumaric acid dibutyl ester
Succinic acid dimethyl ester
Glutaric acid dimethyl ester

Hexandioldiacrylate
Maleic acid dibutyl ester
Butyrolactone
Dimethylphthalate
Texanol
TXIB (Texanolisobutyrate)**

Chlorinated hydrocarbons

Tetrachlorethene
1,1,1-Trichlorethane
Trichlorethene
1,4-Dichlorbenzene

Others

1,4-Dioxane
Caprolactam
N-Methyl-2-pyrrolidone
Octamethylcyclotetrasiloxane
Methenamine
2-Butanonoxime
Tributyl phosphate
Triethyl phosphate
5-Chlor-2-methyl-4-isothiazolin-3-one
Tetrahydrofuran (THF)
1-Decene
1-Octene
2-Pentylfuran

* VVOC

** SVOC



Test method:

Manufacturer of the text object:	DIN EN ISO 16000-11
	Pre-treatment: no
	Sticker on the back: no
	Sticker on the side: no
	Relationship of open edges to the surface: ---
	Charging: related to the surface
	Dimensions: 17.2 cm x 17.2 cm x 15.0 cm
Test chamber requirements:	DIN EN ISO 16000-9
	Chamber volumes: 0.125 m ³
	Temperature: 23°C
	Relative humidity: 50 %
	Air pressure: normal
	Air: cleaned
	Air replacement rate: 1 h ⁻¹
	Upstream flow velocity: 0.3 m/s
	Charging: 1.3 m ² /m ³
	Specific air throughput rate: 0.77 m ³ /m ² *h
	Air sampling: 2 days (CMR VOC) or 7 days after test chamber loading
Analytics:	DIN ISO 16000-6
	Determination threshold: 2 µg/m ³



Measurement time 2 days after test chamber loading

1.1.1 CMR VOC_{2d}

Test aim:

Carcinogenic, mutagenic and reproduction-toxic volatile organic compounds (CMR VOC), test chamber, air sampling 2 days after test chamber loading

Test result:

CMR VOCs were not detectable 2 days after test chamber loading.



1.1.2 VOC / TVOC_{2d}

Test aim:

Volatile organic compounds (VOC), test chamber, air sampling 2 days after test chamber loading

No.	Substance	CAS No.	Concentration (Test chamber air) [µg/m ³]
VOC_{2d}: Identified and calibrated substances in accordance with NIK list/AgBB, computed substance-specifically (c_{id sub})			
1	Aromatic hydrocarbons		
1-1	Toluene	108-88-3	3
7	Aldehyde		
7-8	Decanal	4170-30-3	2
VOC_{2d}: Further identified and calibrated substances in accordance with NIK list/AgBB, computed substance-specifically (c_{id sub})			
-	-	-	-

No.	Substance	CAS No.	Concentration (Test chamber air) [µg/m ³]
VOC_{2d}: Not identified substances calculated as toluene equivalent (c_{ni tol})			
-	N,N-Diethylformamide	-	5
-	Isoalkane with 10 or 11 carbon atoms	-	6

Total volatile organic compounds	Concentration (Test chamber air) [µg/m ³]	SER _a [µg/m ³ h]
TVOC_{2d}	16	12

Note: The test results exclusively refer to the submitted tested material. On changes of the composition or the production procedure of the material the report loses its validity. Publication of the test report requires permission in writing.



1.1.3 $VVOC_{2d}$

Test aim:

Very volatile organic compounds (VVOC), test chamber, air sampling 2 days after test chamber loading

Test result:

No.	Substance	CAS No.	Concentration (Test chamber air) [$\mu\text{g}/\text{m}^3$]
$VVOC_{2d}$: Identified and calibrated substances in accordance with NIK list/AgBB, computed substance-specifically ($c_{id\ sub}$)			
-	-	-	-
$VVOC_{2d}$: Further identified and calibrated substances in accordance with NIK list/AgBB, computed substance-specifically ($c_{id\ sub}$)			
-	-	-	-
$VVOC_{2d}$: Not identified substances calculated as toluene equivalent ($c_{ni\ tol}$)			
-	-	-	-

Note: The test results exclusively refer to the submitted tested material. On changes of the composition or the production procedure of the material the report loses its validity. Publication of the test report requires permission in writing.



1.1.4 SVOC_{2d}

Test aim:

Semi-volatile organic compounds (SVOC), test chamber, air sampling 2 days after test chamber loading

Test result:

No.	Substance	CAS No.	Concentration (Test chamber air) [µg/m ³]
SVOC_{2d}: Identified and calibrated substances in accordance with NIK list/AgBB, computed substance-specifically (c_{id sub})			
-	-	-	-
SVOC_{2d}: Further identified and calibrated substances in accordance with NIK list/AgBB, computed substance-specifically (c_{id sub})			
-	-	-	-
SVOC_{2d}: Not identified substances calculated as toluene equivalent (c_{ni tol})			
-	-	-	-

Total semi-volatile organic compounds	Concentration (Test chamber air) [µg/m ³]	SER _a [µg/m ³ h]
Σ SVOC _{2d}	-	-



Measurement time 7 days after test chamber loading

1.1.5 VOC_{7d} / TVOC_{7d}

Test aim:

Volatile organic compounds (VOC), test chamber, air sampling 7 days after test chamber loading

No.	Substance	CAS No.	Concentration (Test chamber air) [µg/m ³]
VOC_{7d}: Identified and calibrated substances in accordance with NIK list/AgBB, computed substance-specifically (c_{id sub})			
1	Aromatic hydrocarbons		
1-1	Toluene	108-88-3	2
7	Aldehyde		
7-8	Decanal	112-31-2	3
VOC_{7d}: Further identified and calibrated substances in accordance with NIK list/AgBB, computed substance-specifically (c_{id sub})			
-	-	-	-
VOC_{7d}: Not identified substances calculated as toluene equivalent (c_{ni tol})			
-	N,N-Diethylformamide	-	2

Total volatile organic compounds	Concentration (Test chamber air) [µg/m ³]	SER _a [µg/m ³ h]
TVOC _{7d}	7	5



1.1.6 $VVOC_{7d}$

Test aim:

Very volatile organic compounds (VVOC), test chamber, air sampling 7 days after test chamber loading

Test result:

No.	Substance	CAS No.	Concentration (Test chamber air) [$\mu\text{g}/\text{m}^3$]
$VVOC_{7d}$: Identified and calibrated substances in accordance with NIK list/AgBB, computed substance-specifically ($c_{id\ sub}$)			
-	-	-	-
$VVOC_{7d}$: Further identified and calibrated substances in accordance with NIK list/AgBB, computed substance-specifically ($c_{id\ sub}$)			
-	-	-	-
$VVOC_{7d}$: Not identified substances calculated as toluene equivalent ($c_{ni\ tol}$)			
-	-	-	-

Note: The test results exclusively refer to the submitted tested material. On changes of the composition or the production procedure of the material the report loses its validity. Publication of the test report requires permission in writing.



1.1.7 SVOC_{7d}

Test aim:

Semi- volatile organic compounds (SVOC), test chamber, air sampling 7 days after test chamber loading

Test result:

No.	Substance	CAS No.	Concentration (Test chamber air) [µg/m ³]
SVOC_{7d}: Identified and calibrated substances in accordance with NIK list/AgBB, computed substance-specifically (c_{id sub})			
-	-	-	-
SVOC_{7d}: Further identified and calibrated substances in accordance with NIK list/AgBB, computed substance-specifically (c_{id sub})			
-	-	-	-
SVOC_{7d}: Not identified substances calculated as toluene equivalent (c_{ni tol})			
-	-	-	-

Total semi-volatile organic compounds	Concentration (Test chamber air) [µg/m ³]	SER _a [µg/m ³ h]
Σ SVOC _{7d}	-	-

Note: The test results exclusively refer to the submitted tested material. On changes of the composition or the production procedure of the material the report loses its validity. Publication of the test report requires permission in writing.



1.2 Carbon Disulfide CS₂

Test aim:

Emissions of carbon disulfide CS₂ in the test chamber, air sampling 2 days after test chamber loading

Test method:

Manufacturer of the text object:	DIN EN ISO 16000-11 See no. 1.1 VOCs
Test chamber requirements:	DIN ISO 16000-9 and according to DIN EN 717-1 See no. 1.1 VOCs
Air sampling:	2 days after test chamber loading
Analytics:	DIN EN 16000-6
Determination threshold:	1 µg/m ³

Test result:

Substance	Concentration (Test chamber air) [µg/m ³]
Carbon Disulfide CS ₂	< 1



1.3 Nitrosamines

Test aim:

Emissions of nitrosamines in the test chamber, air sampling 2 days after test chamber loading

Test method:

Manufacturer of the test object:	DIN EN ISO 16000-11 See no. 1.1 VOCs
Test chamber requirements:	DIN ISO 16000-9 and according to DIN EN 717-1 See no. 1.1 VOCs
Air sampling:	2 days after test chamber loading
Analytics:	BGI 505-23 determination of nitrosamines Determination threshold: 100 ng/m ³

Test result:

Substance	Concentration (Test chamber air) [ng/m ³]
N-Nitrosodimethylamine (NDMA)	-
N-Nitrosomethylethylamine (NMEA)	-
N-Nitrosodiethylamine (NDEA)	-
N-Nitrosodiisopropylamine (NDIPA)	-
N-Nitrosodipropylamine (NDPA)	-
N-Nitrosodibutylamine (NDBA)	-
N-Nitrosopyrrolidine (NPYR)	-
N-Nitrosopiperidine (NPIP)	-
N-Nitrosomorpholine (NMOR)	-

Note: The test results exclusively refer to the submitted tested material. On changes of the composition or the production procedure of the material the report loses its validity. Publication of the test report requires permission in writing.



1.4 Formaldehyde 2_d

Test aim:

Formaldehyde, test chamber, air sampling 2 days after test chamber loading, repeat determination

Test method:

Manufacturer of the test object:	DIN EN ISO 16000-11 See no. 1.1 VOCs
Test chamber requirements:	DIN EN 717-1 with the following deviations: <ul style="list-style-type: none"> – No determination of the balance concentration; the formaldehyde emission is indicated at a measuring point as determined above. – For test chamber size refer to chamber volumes – Relative humidity: 50% Emissions chamber parameters: See no. 1.1 VOCs Air sampling: 2 days after test chamber loading
Analytics:	DIN EN 16000-3 Determination threshold: 3 µg/m ³ ≈ 0.003 ppm

Test result:

Substance	Concentration (Test chamber air) [µg/m ³]	Concentration (Test chamber air) [ppm]
Formaldehyde	< 3	< 0.003



1.5 Odour testing

Test aim:

Odour, test collective, odour test 24 hours after desiccator loading

Test method:

Analytics:

VDA recommendation 270 at 50 % humidity

Rating scale:

- | | |
|---|--|
| 1 | not discernable |
| 2 | discernable, not objectionable |
| 3 | clearly discernable, not objectionable |
| 4 | objectionable |
| 5 | strongly discernable |
| 6 | intolerable |

Test result:

Temperature [°C]	Intensity [Note]	Type of odour
23	1 - 2	Product typical



2 Contents analysis

2.1 Polymers and filler percentage

Test method:

Analytically:	Ash/filler percentage: Thermogravimetry; Polymer percentage : IR/ATR
Benchmark:	Filler percentage: $\leq 5 \pm 1$ % Polymer percentage: NR ≥ 95 %

Filler percentage	[weight/%]
Related to the total sample the polymer portion amounts to.	95
Related to the total sample the ash portion (including zinc oxide) amounts to.	5
Related to the total sample the filler portion amounts to ¹⁾	< 5
Polymer percentage	[weight/%]
Related to the polymer content the natural latex portion amounts to ²⁾	100
Related to the polymer content the synthetic latex portion amounts to ²⁾	0

¹⁾ The filler portion is calculated by the difference of ash portion and zinc oxide on the assumption that maximally 5% zinc oxide is contained related to the total weight of the expanded latex core.

²⁾ With findings < 5 % for natural latex the result is represented as 100 % synthetic latex. Usually no natural latex portion under 5 % is used.

Cologne, dated 4 March 2008

Dr. H.-U. Krieg
(Technical Manager)



Expert appraisal

The product Natural Latex Foam Mattress Core was submitted to laboratory tests on behalf of Richard Pieris & Co Ltd, Sri Lanka for an ecological product examination according to the eco-INSTITUT-Label test criteria for Latex mattresses with undyed textile coverings.

The results documented in the test report were evaluated as follows.

Complete mattress			
Test parameter	Concentration	Threshold value	Threshold reached [yes/no]
Emissions analysis			
TVOC (total volatile organic compounds) (2 days after test chamber loading)	16 µg/m ³	≤ 400 µg/m ³	yes
TVOC (total volatile organic compounds) (7 days after test chamber loading)	7 µg/m ³	≤ 200 µg/m ³	yes
VOC classified in: K1, K2; M1, M2; R1, R2 (as per TRGS 905, RL 67/548 EC); IARC group 1 & 2A; MAK III1, III2 (2 days after test chamber loading)	< 2 µg/m ³	≤ 2 µg/m ³	yes
VOC (sum) without NIK (7 days after test chamber loading)	2µg/m ³	≤ 100 µg/m ³	yes
VOC (individual sums):			
Sum of sensitizing materials with the following categorizations: DFG (MAK list): Category IV, German Federal Institute for Risk Assessment list: Cat A, TRGS 907 (7 days after test chamber loading)	< 2 µg/m ³	≤ 100 µg/m ³	yes
Sum of VOC with the following categorizations: Directive 67/548 EC: Carc. Cat. 3, Mut. Cat. 3, Repr. Cat. 3, TRGS 905: K3, M3, R3, IARC: Group 2B, DFG (MAK lists): Category III3 (7 days after test chamber loading)	< 2 µg/m ³	≤ 50 µg/m ³	yes
Disulphide (only latex products)	< 1 µg/m ³	≤ 50 µg/m ³ (2 days after test chamber loading)	yes
Nitrosamine (only latex products)	< 0.1 µg/m ³	≤ 0.3 µg/m ³ (2 days after test chamber loading)	yes
R value	≤ 1,0	≤ 1.0 (7 days after test chamber loading)	yes
Formaldehyde	< 0.003 ppm	≤ 0.02 ppm (2 days after test chamber loading)	yes
Odour	1 - 2	≤ Grade 3 (24 hours after loading of desiccator)	yes
Contents analysis			
Polymer percentage	Result	Declaration in %	yes
Filler portion (ash content)	Result	≤ 5%	yes

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Summary evaluation

The product Natural Latex Foam Mattress Core was submitted to an ecological product examination on behalf of Richard Pieris & Co Ltd, Sri Lanka for the acquisition of the eco-INITIUT-Label.

The laboratory analysis was successfully completed.

As a result of the successful ecological product examination the

eco-INITIUT-Label



Is awarded for the product/s:
Natural Latex Foam Mattress Core
for a period of two years.

Certification number	ID 0208 – 12826 – 001
Test report Number	17984
Validity	03/2010

At expiration of two years the possibility exists of acquiring the eco-INITIUT-Label for another two-year period. For this a laboratory test would be accomplished according to the latest eco-INITIUT-Label test criteria.

Cologne, dated 4 March 2008

Ms. Aleksandra Vujovic
(Project Manager)



Appendix

Explanation of specific emission rate SER

Emission measurements are accomplished in test chambers under defined physical conditions (temperature, relative humidity, room loading, change of air rate etc.).

Test chamber measurement results are directly comparable only if the investigations were accomplished under the same basic conditions.

If the differences of the physical conditions refer only to the change of air rate and/or the loading, the "SER" or "specific emission rate" can be used for comparability of the measurement results. The SER indicates how many volatile organic compounds (VOC) are released by the sample for each material unit and hour (h).

The SER can be calculated using the formula below for each proven individual component of the VOC from the data in the test report.

As material units the following are applicable:

l = unit of length (m)	refers the emissions of the length
a = unit area (m ²)	refers the emissions of the surface
v = unit volume (m ³)	refers the emission to the volume
u = piece unit (unit = piece)	refers the emission to the complete unit

From this the different dimensions for SER result:

length-specific	SER _l in µg/m h
surface-specific	SER _a in µg/m h
volume-specific	SER _v in µg/m ³ h
unit specific	SER _u in µg/u h

SER thus represents a product specific rate, which describes the mass of the volatile organic compound, which is emitted by the product per time unit at a certain time after beginning of the examination.

$$\boxed{\text{SER} = q \cdot C}$$

q	specific air flow rate (quotient from change of air rate and loading)
C	Concentration of the measured substance(s)

The result can be indicated in milligrams (mg) in place of micro grams (µg), whereby 1 mg = 1000 µg.