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**Rim Fabrics**

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# **Environmental Compliance Testing of Textile Fabric Product**

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# 1 EXECUTIVE SUMMARY

Cetec has completed environmental testing of fabric products supplied by Rim Fabrics.

The emission rate of fabric products tested in small environmental chambers fulfilled the Green Building Council of Australia “Green Star Office Interior” compliance requirements. The average emission rate of TVOC at 7 days for all products tested was negligible at less than 0.005 mg/m<sup>2</sup>/hr. All fabric products produced by Rim Fabrics can be classified as low-VOC emitting.

The results achieved in this testing program are expected to be typically higher than emission rates and concentrations actually found in real indoor environments.

The heavy metal content of the fabric products was negligible and well below the AELA specification. All fabric products produced by Rim Fabrics can be classified as having a low heavy metal content.

## 2 INTRODUCTION

Rim Fabrics, a leading supplier of commercial fabrics for wall and acoustic panels, commissioned Cetec Pty Ltd to undertake environmental testing of their range of products. Their textile products are based upon polyester construction.

Rim Fabrics is seeking to have their product approved for Eco-Labeling in Australia. Obtaining Ecolabel status requires the meeting of a number of environmental performance criteria. To assist Rim fabrics compile the information for achieving Ecolabel status Cetec tested their product for heavy metal content.

Cetec also conducted a material emissions study of the Rim Fabric products to confirm compliance with the Green Building Council of Australia emission guidelines and show they have minimal impact on the indoor environment. The technique used diffusive sampling methods using small environmental chambers. The products were monitored for their environmental emissions of total organic volatile compounds at the 7-day period.

The study was carried out by Cetec located in Melbourne in November 2005.

## **3 BACKGROUND**

### **3.1 Indoor Air Quality**

Indoor air quality (IAQ) is an important environmental consideration. People generally spend as much as 90 percent of their time in indoors and therefore, the quality of indoor air has a vital impact in human health. Today, buildings are designed to be airtight to save energy, resulting in less fresh air intake and a general build up of pollutants from building materials in the indoor environment.

In Australia the National Health and Medical Research Council (NHMRC) defines indoor air as the air within a building occupied for at least one hour by people of varying states of health. This includes any non-industrial indoor space i.e. office, classroom, transport facility, shopping centre, hospital and home. Indoor air quality can be defined as the totality of attributes of indoor air that affect a person's health and well being.

Increasingly, as buildings have become better sealed from the external environment, pollutants released from indoor sources are being found at higher concentrations. Besides, the quality of air drawn from outside, the indoor environment is impacted by many factors. One group of indoor air pollutants is Volatile Organic Compounds (VOC). The number of complaints about indoor pollution caused by VOC has increased in recent times. Potential sources of indoor VOC include paints, decorative surface coatings, cleaning agents, finishes applied to textiles, solvents, adhesives, floor varnishes, furniture and carpets. These type of products all have the potential to impact the indoor air because they emit VOC into the air.

### **3.2 Textiles**

To avoid IAQ issues in workplaces and homes, interior furnishings should be low VOC emitters, with emissions, (sometimes improperly called off-gassing), that dissipate quickly. Textiles are made primarily of the same innocuous materials found in clothing and other everyday fabrics; e.g., polyester, nylon, or wool.

### 3.3 Volatile Organic Compounds

Volatile organic compounds (VOC) are organic compounds that often cause odours and irritation. The World Health Organisation (WHO) defines VOC as organic compounds with boiling points between 50°C and 260°C, excluding pesticides. Australia's National Health and Medical Research Council (NHMRC) has accepted the same WHO definition of VOC. The term encompasses a very large and diverse group of carbon-containing compounds, including aliphatic, aromatic and halogenated hydrocarbons, aldehydes, ethers, esters, acids, alcohols and ketones.

The extent to which VOC can cause health problems depends on their toxicity, concentration and the duration of personal exposure. The health impacts resulting from exposure to individual chemical substances in building materials are not well understood. Many chemicals present in indoor air environments have not been evaluated thoroughly and little is known about their long-term health effects. Generally, the health effects of exposure to VOC in non-industrial indoor environments range from sensory irritation at low/medium levels of exposure to toxic effects at high exposure levels.

The measurement of total volatile organic compounds (TVOC) is frequently used to assess indoor air quality because the interpretation of a single parameter is simpler and faster than the interpretation of the concentrations of several dozen VOC typically detected indoors. Non-specific TVOC measurements are a useful monitor for determining physical changes in a building's indoor environment.

### 3.4 Regulatory Limits

No regulations or codes have been developed specifically for indoor air in Australia except for some specific substances in the workplace environments. No single government authority in any jurisdiction has responsibility for indoor air quality in Australia. As such, there are no national regulations for VOC.

In contrast to workplace and ambient air environments, there are no enforceable regulations specifically for nonworkplace indoor air environments. This situation is also common overseas. Regulating indoor air out of the workplace is difficult because

any imposition of mandatory indoor air quality monitoring would be viewed by many people as unreasonably intrusive, particularly if private homes were to be included.

An alternative approach is to identify the sources of indoor air pollutants and other factors affecting indoor air quality and to make this information widely available. People can then make informed choices about matters affecting indoor air quality, at least in their homes. Individuals have limited ability to influence indoor air quality in public buildings such as schools, offices, hospitals and shopping malls, and a stronger case can be made for setting indoor air quality standards and/or guidelines for such buildings.

The State of Washington (United States) has established criteria for pollutant emissions from manufactured products, interior materials and other pollutant sources in commercial buildings. The emission criteria were designed to ensure that after 30 days building air concentrations do not exceed the limit of 500  $\mu\text{g}/\text{m}^3$  for TVOC.

Overseas initiatives on source emission limits to prevent TVOC concentrations above 500  $\mu\text{g}/\text{m}^3$  per source have been described for the United States. The emphasis is placed on maximum emission rate rather than total concentration. These are presented below:

<b>Material or product</b>	<b>Maximum emission</b>
Floor materials or coatings	600 $\mu\text{g TVOC}/\text{m}^2$ /hour
Wall materials or coatings	400 $\mu\text{g TVOC}/\text{m}^2$ /hour
Moveable partitions	400 $\mu\text{g TVOC}/\text{m}^2$ /hour
Office furniture	2500 $\mu\text{g TVOC}/\text{hour}/\text{workstation}$
Office machines (central)	250 $\mu\text{g TVOC}/\text{hour}/\text{m}^3$ of space; 10 $\mu\text{g ozone}/\text{hour}/\text{m}^3$ of space
Office machines (personal)	2500 $\mu\text{g TVOC}/\text{hour}/\text{m}^3$ of space; 100 $\mu\text{g ozone}/\text{hour}/\text{m}^3$ of space

In 1990, European carpet manufacturers formed Gemeinschaft Umweltfreundlicher Teppichboden (GUT), an association of environmentally friendly carpet manufacturers based in Germany, with members throughout Europe. GUT aims to be proactive in ensuring its members develop products with minimal impact on the environment and demonstrate their commitment to the environment. GUT sets test standards, which in some cases are more stringent than any national standards.

The standards cover three areas:

- Chemical content of products with an agreed list of materials which must be absent or below strict limits;
- Emission tests with limits for individual chemicals and total volatile organic compound (TVOC) emissions; and
- Odour tests which are carried out in standardized conditions by a team of experts.

In January 2004, GUT thresholds for emissions were replaced by a new evaluation scheme is based upon the ECA-18-system and is compatible with other systems such as the procedure suggested by AgBB (Committee for Health-related Evaluation of Building Products) for the evaluation of building products used for large indoor areas. GUT limits for emissions, odour and pollutants exceed the legal requirements of European and national governments.

In the field of the GUT product test the chemical emissions are evaluated on the basis of the following requirements after 72hours after application:

- TVOC < 0.300 mg/m<sup>3</sup>
- Formaldehyde < 0.01 mg/m<sup>3</sup>

The Green Building Council of Australia has established several “Green Star” rating schemes that include reference to low-VOC emitting products. In the case of the Rim Fabrics products they are best covered by the “Green Star Office Interior” rating scheme. Office fit out items within seven days of unpacking must have TVOC emission levels of:

- Workstations, Wall/Partitions, Tables and Storage Units < 0.5 mg/m<sup>2</sup>/hr
- Chairs < 0.25 mg/m<sup>2</sup>/hr

Since Rim Fabrics is a supplier of a component to office fit out items then showing it can meet the same requirement as above provides reassurance that its presence in the office fit out item will not compromise the total emissions.

## 4 METHODOLOGY

The scope of environmental testing included a material emission study and selected heavy metal content of fabric product. The basic aim of the material emission study was to measure the emission rate of TVOC in mg/m<sup>2</sup>/hr from fabric product after a 7-day period. Heavy metal content of fabric was defined by section 3.3.5 of the Australian Environmental Labelling Association standard AELA 19-2004 Textile Products.

### 4.1 Material

Rim Fabrics selected and supplied to Cetec a sample of each of their nominated textile fabric products (Table 1). These products can be considered representative of the whole Rim Fabrics range. For example, “Trilogy Three” is the same material as “Trilogy Two” but with a different print design.

**Table 1: Sample Identification and Description – Fabric Material**

<b>Sample Identification</b>	<b>Description</b>
57454	“Trilogy One” fabric
57455	“Trilogy Two” fabric.
57456	“Metallica” fabric
57457	“Vital” fabric
57458	“Evolve” fabric

### 4.2 Method – Material Emissions

The environmental chambers are constructed of glass with an aluminium seal. Sample specimens of ca. 0.30m<sup>2</sup> to 0.70m<sup>2</sup> total surface area were placed in the small environmental chamber and immediately sealed. A wire frame allowed the sample

specimens to be held vertically so that emissions from both sides of the material could be collected. The experimental conditions for all emission measurements in the chamber were at a controlled temperature of  $23^{\circ}\text{C}\pm 2^{\circ}\text{C}$ . ASTM D5116 provides further details about small-scale environmental chambers<sup>(1)</sup> for emission testing.

The chemicals emitted from the material were determined using a diffusive sampling method. The method is based on AS2986.2 and ISO 16200<sup>(2)</sup>. Air from the environmental chamber is passed through absorbent material. The collected emissions are desorbed by solvent and analysed. The TVOC was determined using gas chromatography (GC) equipped with flame ionisation spectroscopy (FID). The TVOC was quantitated by reference to toluene.

### 4.3 Method – Heavy Metal Content

The experimental approach followed USEPA 6010B Heavy Metals and USEPA 7470/71 Mercury methodology.

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1 ASTM D5116-97, Standard Guide for Small-Scale Environmental Chamber Determinations of Organic Emissions from Indoor Material/Products.

2 AS2986.3-2003 is identical with and reproduced from ISO 16200-2:2000, Workplace air quality – sampling and analysis of volatile organic compounds by solvent desorption/gas chromatography, Part 2: Diffusive sampling methods.

## 5 RESULTS

### 5.1 TVOC Concentration & Emission Levels

The concentrations of TVOC emitted from fabric material under study together with the calculated emission rates are shown in Table 2.

**Table 2: TVOC Emission Data**

Laboratory Identification	Product	7 Days	
		Concentration (mg/sample)	Specific Area Emission rate (mg/m <sup>2</sup> /hr)
Blank		0.001	Not Applicable
57454	“Trilogy One”	0.010	0.002
57455	“Trilogy Two”	0.020	0.002
57456	“Metallica”	0.020	0.003
57457	“Vital”	0.003	0.001
57458	“Evolve”	0.006	0.001

For all fabric product tested the TVOC emission rate at 7 days was negligible and conforms to the “Green Star Office Interior” specification. These results can be considered representative for the whole range of the Rim Fabrics products.

Examination of the gas chromatogram profile of the emissions from each upholstery product identified the TVOC as predominantly toluene. This chemical compound in the very low emissions from the products would not pose a health issue to humans. Certainly no recognised chemicals of concern; e.g. carcinogens, mutagens or teratogens, were detected in the chemical emissions.

## 5.2 Environmental Chambers

While larger buildings are more likely to have mechanical ventilation systems that can filter out some pollutants, buildings are designed to be air-tight to save energy, resulting in less fresh air intake and a general build up of pollutants from building materials in the indoor environment. For this study, small environmental chambers adopting passive adsorption techniques were used to better mirror the real indoor environment compared to an active system; in addition diffusive emissions are not affected by airflow.

The TVOC emission rates and concentrations in the chamber measured in this study are likely to be higher than concentrations in a real environment because:

1. The chamber concentrations were for fresh material and measured in a static environment. Even with limited natural ventilation in a building and assuming a declining emission with age; the chamber method should result in higher concentration than in a non-industrial environment.
2. Concentrations depend on the amount of carpeted surfaces in the premises and the air exchange rate. In most cases, the area-to-volume ratio in the chamber will differ from the ratio in a commercial office. The lesser the loading ratio, the lower the total concentration of the materials in the environment.
3. Indoor air quality is affected by a number of factors including the ability of other surfaces to adsorb VOC. Some furnishing within a room may act as sink for VOC of low volatility, which may then be re-emitted over extended times at lower rates, resulting in lower emissions.

## 5.3 Heavy Metal Content

Table 3 provides the detail of heavy metal content of the fabric products.

**Table 3: Heavy Metal Content**

Metal	Product					AELA Specification ppm
	“Trilogy One” ppm	“Trilogy Two” ppm	“Metallica” ppm	“Vital” ppm	“Evolve” ppm	
<b>Antimony</b>	<10	48	10	11	14	<b>250</b>
<b>Arsenic</b>	<2	<2	<2	<2	<2	<b>50</b>
<b>Barium</b>	<10	<10	<10	16	<10	<b>100</b>
<b>Cadmium</b>	<0.5	<0.5	<0.5	<0.5	<0.5	<b>50</b>
<b>Chromium</b>	<5	<5	<5	<5	<5	<b>100</b>
<b>Lead</b>	<5	<5	<5	<5	<5	<b>100</b>
<b>Mercury</b>	<0.1	<0.1	<0.1	<0.1	<0.1	<b>25</b>
<b>Selenium</b>	<2	<2	<2	<2	<2	<b>100</b>
<b>Zinc</b>	<5	<5	<5	<5	<5	<b>1000</b>

In the vast majority of cases the heavy metal content was below the detection limit. Nevertheless with all products the heavy metal content was well below the specification. These results can be considered representative of the whole range of Rim Fabrics products.

## 6 CONCLUSION

Environmental testing of fabric products from Rim Fabrics has been completed. The products tested included “Trilogy One”, “Trilogy Two”, “Metallica”, “Vital” and “Evolve”. These products can be considered representative of the whole Rim Fabrics range. For example, “Trilogy Three” is the same material as “Trilogy Two” but with a different print design. Both material emissions and heavy metal content were tested.

The emission rate of fabric products tested in small environmental chambers fulfilled the Green Building Council of Australia “Green Star Office Interior” compliance requirements. The average emission rate of TVOC at 7 days for all products tested was negligible at less than 0.005 mg/m<sup>2</sup>/hr. All fabric products produced by Rim Fabrics can be classified as low-VOC emitting. The chemical compounds detected in the very low VOC emissions from the products were not recognised chemicals of concern and would not pose a health issue to humans.

The heavy metal content of the fabric products was negligible and well below the AELA specification. All fabric products produced by Rim Fabrics can be classified as having a low heavy metal content.



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