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Chemical Emissions Testing of Armstrong Dune Square Edge Ceiling Panel – Total Volatile Organic Compounds

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1 EXECUTIVE SUMMARY

Cetec Pty Ltd has tested the total volatile organic compound emissions from Armstrong Dune Square Edge ceiling panel product. This product was tested using the general methods and principles outlined in ASTM D5116 "Standard Guide for Small-Scale Environmental Chamber Determinations of Organic Emissions from Indoor Material/Products".

The Armstrong Dune Square Edge product was a low VOC emitting product.

The product met the requirements of Green Building Council of Australia G reen Star Office Design IEQ-13 and Office Interiors IEQ-11.

2 INTRODUCTION

Armstrong World Industries (Australia) Pty Ltd is a global leader in the design and manufacture of floors, ceilings and cabinets. Mr. Paul McDonald, Marketing & Strategic Accounts Manager, commissioned Cetec Pty Ltd to undertake an emission study of the Dune Square Edge ceiling panel product.

Presently there is intense activity in Australia regarding building sustainability or "green buildings". Organisations have formed to drive the adoption of "green building" practice; e.g. Green Building Council of Australia, or to recognise environmentally friendly products; e.g. Ecospecifier or Good Environmental Choice Australia.

Building products are coming under scrutiny for their environmental impact. One parameter of interest is the emission of volatile organic chemicals from construction materials. Volatile organic compounds are chemicals that often cause odours and irritation and are not conducive to a healthy indoor environment.

Armstrong World Industries requested Cetec to undertake chemical emissions testing of Armstrong Dune Square Edge product to quantify the potential volatile organic compounds that may be present.

Total volatile organic compound emissions from Armstrong Dune Square Edge ceiling panel were determined using an environmental chamber. Cetec Pty Ltd conducted the study in Melbourne during June – July 2008.

3 METHODOLOGY

The test program involved the determination of total volatile organic compound (TVOC) emission rate within 24 hours of receipt of test material. The methodology followed ASTM D5116 "Standard Guide for Small -Scale Environmental Chamber Determinations of Organic Emissions from Indoor Material/Products".

3.1 Material

Armstrong supplied ceiling panel product in a sealed carton as detailed in Table 1. Cardboard had been applied around the edges of a stack of ceiling tiles and then the carton shrink-wrapped tightly. Figure 1 shows as example of the Armstrong Dune Square Edge ceiling panel product.

Table 1: Sample Identification and Description – Ceiling Panel

Sample Identification	Description
64273	Armstrong Dune Square Edge Ceiling Panel (RH99 board - item 3641)

Inside the sealed carton were several stacked product panels from which a test panel was selected from the middle. A portion of this test panel was then prepared for testing in an environmental chamber.

Figure 1: Armstrong Dune Square Edge board showing the product face pattern.

3.2 Methods

The environmental test chamber used was as described by ASTM D5116 [(1)]. Experimental conditions comprised:

- Temperature: $23^0C \pm 1^oC$;
- Relative Humidity: 50%±5%;
- Air exchange rate of 1 per hour; and
- Product loading of 0.5 m^2/m^3.

Upon opening the received package a test sample was prepared and immediately placed into an environmental chamber.

1 ASTM D5116-06, Standard Guide for Small-Scale Environmental Chamber Determinations of Organic Emissions from Indoor Material/Products.

Air from the environmental chamber was passed through specific absorbent material to trap the VOCs emitted by the test material at 24 hours. The TVOC was determined using gas chromatography (GC) equipped with mass spectroscopy detection (MS) and quantitated by reference to toluene. Identification of volatile organic compounds emitted from the material under test could also be done.

4 RESULTS

4.1 Concentration & Emission Levels

Table 2 summarises for the test material the concentration of emitted chemical species together with the calculated average emission rates.

Table 2: Volatile Organic Compound Emissions Data

Laboratory Identification	Product	24-Hours	
		Specific Area Emission Rate ($mg/m^2/hr$)	Concentration (mg/m^3)
64273	Armstrong Dune Square Edge Ceiling Panel	TVOC: 0.006	<0.005

Total volatile organic compounds emitted by the ceiling panel material were low and would be acceptable for:

- Green Star Office Design with a maximum limit for emission rate of 0.5 $mg/m^2/hr$; or
- Green Star Office Interiors with a maximum limit for emission rate of 0.5 $mg/m^2/hr$ or a maximum potential airborne concentration of 0.5 mg/m^3.

Examination of the gas chromatogram profile of the emissions from the product did not identify any Class 1 or 2A carcinogens (International Agency for Research on Cancer). Certainly no recognised chemicals of concern; e.g. carcinogens, mutagens or teratogens, were detected in the chemical emissions. The product can be classed as low VOC emitting.

4.2 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 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 floor 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 CONCLUSION

Cetec Pty Ltd has completed the materials emission testing of Armstrong Dune Square Edge ceiling panel. The product can be classed as low -VOC emitting.

The product met the requirements of the Green Building Council of Australia Green Star rating scheme:

- The TVOC emission rate was 0.006 mg/ m^2/hr and this is below the Office Design IEQ-13 limit of 0.5 mg/m^2/hr.
- The TVOC airborne concentration was less than 0.005 mg/m^3 and this is below the Office Interiors IEQ-11 limit of 0.5 mg/m^3.

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