



# Indoor Air Quality

Australians typically spend 90% of their time indoors - so indoor air quality is an important factor in protecting health and wellbeing.<sup>1</sup>

The main factors that affect indoor air quality are:

- inadequate ventilation which may occur if heating, ventilating and air-conditioning systems (HVAC) are ineffective,
- chemical contaminants from inside and outside the building – these include volatile organic compounds (VOCs),
- biological contaminants e.g. bacteria, moulds, pollen.

Extensive research is being undertaken to evaluate the effects of products on indoor air quality. Many countries have instituted standards and voluntary codes of practice that set guidelines for indoor air quality.

The Carpet Institute of Australia Limited is conducting a comprehensive study of the environmental impact of carpet, and indoor air quality is part of this investigation. Here, we cover the key issues.

## VOC Emissions

VOC emissions consist of a range of volatile organic compounds which at room temperature may be released from materials or products in the form of gases. Some of the common sources of VOCs in the indoor environment are cleaning agents and polishes, cosmetics and deodorants, dry cleaned clothing, building materials (e.g. adhesives, laminates, caulking compounds, medium density fibre board), furnishings (furniture, drapery and floor coverings), office equipment (e.g. photocopiers and laser printers), cigarette smoke and air drawn from outside.

The health effects depend on the specific composition of the VOCs present and the length of human exposure. Build-up of VOCs in indoor environments have been associated with 'sick building syndrome'.

*“Carpet has a purifying impact on indoor air quality by absorbing some of the toxic VOCs and trapping particulates.”*

## Carpets and VOC Emissions

As part of the manufacturing process, carpet is generally baked in a finishing oven at 150°C to 170°C. This drives off most of the volatile chemicals including solvents in adhesives and raw materials, leaving a product with a low remaining VOC content.

The VOC most commonly associated with new carpet is 4-phenylcyclohexene (4-PC) – a by-product of the manufacture of synthetic latex. 4-PC has a low odour threshold (0.5 parts per billion) so its presence can be detected at extremely low concentrations when the carpet is first laid.

When compared to other building materials with significant indoor exposure, carpet is a minor contributor to VOC emissions. Approximately 90% of all VOCs discharged from carpet dissipate within 2 days of installation.

With good room ventilation, new carpet VOC emissions will drop below most indoor air quality criteria within a few days.

As can be seen from the following table, new carpet VOC emissions are approximately 3 milligrams per square metre per hour (mg/m<sup>2</sup>.h). After 96 hours, carpet VOC emissions fall to less than 1% of the initial value.<sup>2</sup>



## VOC Emissions of Building Products

| Product                     | <sup>1</sup> Initial emission rate of VOCs (mg/m <sup>2</sup> .h) | <sup>2</sup> Time for 90% loss of VOCs emissions | <sup>2</sup> Total VOC emissions per square metre (mg/m <sup>2</sup> .h) | <sup>3</sup> VOC emissions after 96 hours (mg/m <sup>2</sup> .h) |
|-----------------------------|---|--|--|--|
| Carpet*                     | 3   | 2 days   | 58   | Less than 0.5  |
| Particle Board              | 1.2   | 1 week approx.                                   | 1,000  |  |
| Medium Density Fibre Board  | 0.4 (formaldehyde only)   | 5 months   | 650 (formaldehyde only)  |  |
| Enamel Paint                | 7,600   | 6 hours  | 20,000   |  |
| Acrylic Paint (water based) | 151 average   | 1 day  | 1260 average   | approx. 40   |
| Low Odour Acrylic Paint     | 80  | 1 day  | 730  |  |

\* tested loose laid

In addition, carpet has a purifying impact on indoor air quality by absorbing some toxic VOCs and trapping particulates present in indoor air. For example, carpets irreversibly remove VOCs, including the toxics formaldehyde, sulphur dioxide and nitric oxide.<sup>4</sup>

### Carpets and Airborne Particles

Carpet also has a beneficial effect by trapping small particles in the fibre mass and removing them from the air we breathe. A recent scientific study found that carpet reduces dust in the air to half of that found with hard flooring systems.<sup>5</sup>

| Description <sup>5</sup>                           | Particulates (µg/m <sup>3</sup> ) |
|--|-----------------------------------|
| Fine dust concentration with hard floor covering   | 62.9                              |
| Fine dust concentration with carpet floor covering | 30.4                              |
| German Maximum Permitted Concentration             | 50.0                              |

Carpet made in Australia and New Zealand generally meets Australian requirements for indoor air quality including the National Occupational Health and Safety Commission occupational limits and the National Health & Medical Research Council Interim National Indoor Air Quality Goals.

### Importance of Carpet Maintenance

Frequent vacuuming and periodic deep cleaning by a trained operator is essential for ensuring carpet stays in good condition. The Standard – AS/NZS 3733. 1995 Textile floor coverings – Cleaning maintenance of Residential and Commercial Carpeting provides guidance for good cleaning practice. For a referral to a trained operator, contact the National Upholstery and Carpet Cleaning Association (NUCCA) at [www.nucca.asn.au](http://www.nucca.asn.au) or call 1800 621 872.

A properly maintained carpet should have only positive effects on Indoor Air Quality.

### Installation Tips

- The area should be ventilated with fresh air during installation to avoid re-circulation of air. Most emissions dissipate quickly with adequate air exchange and ventilation.
- Vacuum the floor after the old carpet and underlay have been removed.
- Operate the ventilation system at the normal room temperature for 72 hours after installation. If possible open windows and doors to maximise fresh airflow.
- If carpet adhesives are used, ask for a low VOC emitting water-based adhesive.
- If you are sensitive to VOC emissions, leave the premises during and immediately after carpet installation.

### References

1. State of Knowledge Report: Air Toxics and Indoor Air Quality in Australia, Dept. of the Environment and Heritage, Commonwealth of Australia 2001
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3. Communication from Prof. Alan Hedge – Design and Environmental Analysis, Cornell University (Ithaca)
4. WRONZ – Carpet Performance – Wool carpets and the indoor environment 2002 ([http://www.canesis.com/Documents/Performance\\_Indoor\\_environment.pdf](http://www.canesis.com/Documents/Performance_Indoor_environment.pdf))
5. German Allergie and Asthma Bund, Media Release 18 June 2005

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The “*Carpet It Just Feels Better*” campaign is an initiative of the Carpet Institute of Australia, a non-profit association sponsored by carpet manufacturers, their suppliers and other companies that provide goods and services to the broader carpet industry.

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