

## POSITION PAPER:

**EcoSoft® - Wet or Green Concrete Slabs, Carpet Tile Adhesives & VOC's**  
**Revised May 2013 (Update July 2020)**

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Reduced construction schedules, questionable concreting processes and incorrect carpet tile adhesives and/or applications have contributed to cause an increase in flooring installation failures within buildings. In some cases, it has resulted with the release of potentially harmful Volatile Organic Compounds (VOC's) into the indoor air environment. This is a complex interaction of factors and this paper is an attempt summarize the perspectives that are relevant to flooring and to the position EcoSoft® backed carpet tiles within this discussion.

Moisture build-up under non-porous flooring types, such as Vinyl sheet, Resilient flooring (LVT/SPC), glued timber floors and PVC/Bitumen hard-backed carpet tile may expose the adhesive and product backings to high pH levels; this is a result of Alkalis within the concrete culminating in surface moisture, which becomes entrapped underneath the floor finish. The chemical reaction that follows is the alkaline hydrolyzing (also known as *re-emulsification*) of some adhesives and possibly the plasticizers in certain modular tile backings. This results in chemical breakdown and the release of potentially harmful VOC's, often noticed by a bad odor. Being volatile, VOC's will evaporate into the ambient indoor air at normal room temperature, whereby the adverse health effects of exposure to VOCs by Humans is commonly known as '*sick building syndrome*' causing nose and skin irritation, sore throat, nausea, headache, lethargy, etc. Another contributor to sick building syndrome may be longer term build-up of fungal and/or bacterial growth in the moist environment entrapped underneath the floor covering.

In the past, solvent based adhesives tolerated high pH levels, but these were abolished due to concerns about VOC's from the solvents used in the adhesive itself. The key changes that appear to have been catalysts for these current flooring problems are:

- The introduction of low or non-solvent, water-based adhesives
- Shorter concrete slab curing periods due to faster construction schedules
- Failure to invest in required water barrier and/or sealants by builders prior to applying floor finishes
- The significant rise in the use of hard backed (non-porous) modular floor coverings, including carpet tile (superseding porous broadloom carpet / underlay)

Some articles mention that over burnishing of the slab can be a significant part of the problem. Burnishing is the final treatment of the newly poured slab that makes the surface denser and thus slows down the escape of water vapor. The resulting fine finish is however, unsuitable for water-based polymer type adhesives, as they cannot "key" properly to grab the surface of the slab. To this extent a light grinding is often necessary at additional expense to the project investor. Another possible issue is that of '*hydraulics*' where moisture vapor pressure release can physically uplift non-porous flooring from remaining in contact with the Slab.

Today's building schedules will often see floor-finishes being installed within two to four months after the slab has been poured. Imbedded moisture (damp) that is still within the slab at this stage then becomes entrapped as the floor-finishes are not porous to breathe. In an attempt to remedy this, variations of water to cement ratios, moisture barriers and concrete additives are being experimented with, but the range of factors make this a very complex and risky problem. Some of these interacting factors are:

- Water to cement ratio (varied due to strength requirements and handling properties)
- Sub-structure (earth, gravel bases, insulation and moisture barriers beneath the slab)
- Ground moisture content at basement/ground level
- Temperature and humidity differentials between the ground, slab, and indoor environment
- Relative humidity (RH) and ability for moisture to escape from within enclosed spaces or from over burnishing)
- Slabs on-ground generally drying from one side only
- Various initial curing methods

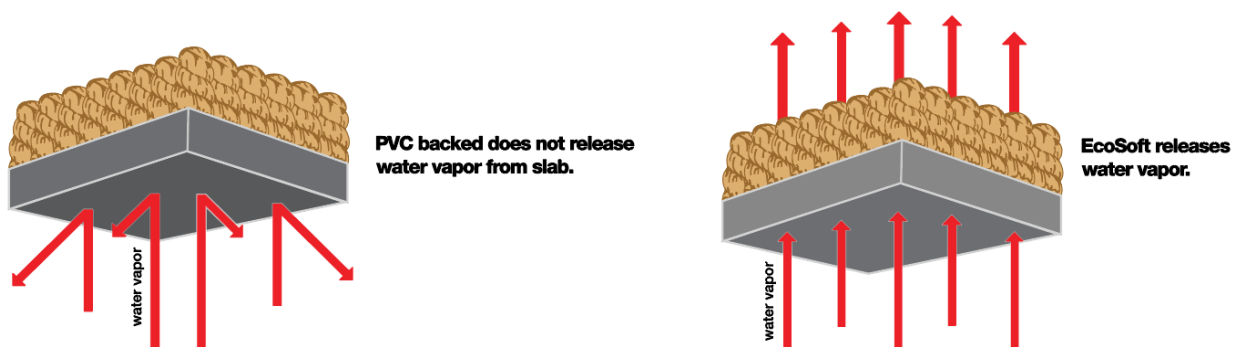
Add to this the difficulty of actually measuring the moisture content in a slab. Current building standards recommend measuring the moisture in all slabs (including old ones) prior to flooring installation should be compulsory, but there is the problem of who conducts the test, which locations to test and who bears the costs of this testing and monitoring. Some of these processes require drilling into the slab to place RH monitors. Moisture or in-slab RH testing methods are poorly understood and are yet to reconcile the requirements of current industry needs and practices, let alone allowing for the most recent advances in carpet tile backing technologies.

VOC issues or observing floor-coverings releasing from the slab are generally the initial sign of failure. When moisture with high pH levels becomes trapped under a non-porous floor-covering it will inundate (re-emulsify) the adhesive. The following reaction referred to as '*alkaline hydrolysis*', alters the chemical structure of the adhesive, effectively turning it into a non-adhering milky-like paste:

*"The standard adhesive bond contains poly (butyl acrylate-co-2-ethylene-hexyl acrylate) in which butyl and 2ethylhexyl groups are attached to a backbone of acrylate groups. If hydrolysis breaks the polyester bond the butyl and 2ethylhexyl groups are split off and released as volatile butanol and 2ethylhexanol."*

Note: Anders Anderberg – 2008 independent report (<http://lup.lub.lu.se/record/1148584>) on the effect of pH on adhesives quoted in TN 024 Concrete and Moisture Sensitive Coverings, Building & Construction Research & Consultancy report.

The 2ethylhexanol is an unpleasant VOC noticed by its acrid smell and adverse reactions by the building occupants. There are also concerns that this hydrolysis reaction migrates into common tile backings affecting the phthalate plasticizer.



Water vapour can escape from the surface of a slab through porous flooring or breathable finishes, as it did in the past via porous broadloom carpet and underlay. EcoSoft® carpet tile backing is a polyester felt, made from fine strands of recycled PET compressed into a sheet about 4mm thick; it is inherently porous. EcoSoft® is an innovation in carpet tile backing by Carpets Inter, and because of its porous characteristics EcoSoft® avoids moisture build up under the tile and the related problems. EcoSoft® contains no plasticizers, gaining its flexibility from the felt-like structure, so avoiding the risk of VOC's from hydrolyzed plasticizer.

To date indications are that EcoSoft® backed carpet tiles are performing well under current conditions and are yet to be reported amongst the current crop of flooring adhesive failures and VOC problems.

Generally, manufacturers will not warrant their non-porous backed products to be installed onto a slab that is tested to be above 70<75% RH and has a pH value outside of between 7 < 9 for fear of re-emulsification of the adhesive and adhesion failure. The porous characteristics of EcoSoft® PET Felt backed carpet tile allows the slab to progressively release inherent water vapor (i.e., dry-out), thus minimizing the risk of adhesive failure through alkaline hydrolysis and the release of VOC's. To this end, Carpets Inter have taken the unprecedented step of warranting EcoSoft® backed modular carpet tile against failure due to wet slab providing the procedure of installation is undertaken as outlined (<https://www.carpetsinter.com/installation-guideline>).

An extract from the EcoSoft® installation guideline illustrates the required floor preparation and adhesive application method to be used aligned to the RH & pH of the specific facility:

EcoSoft Backing Construction - Wet Slab Installation					
Moisture Content (MVER Method)	PH Level (Surface of Substrate)	Application Method (Refer to CI Guideline)	Substrate Treatment		Generic Adhesive (Refer to CI Guideline)
			Burnished	Other	
< 5 lbs./1000 ft2/ 24 hrs. for MVER or < 75% RH	Between 7 < 9	V-Notch Trowel	Not Required.	Not Required.	Pressure Sensitive
< 5 lbs./1000 ft2/ 24 hrs. for MVER or 75% to 89% RH	Between 7 < 9	V-Notch Trowel	Not Required.	Not Required.	Pressure Sensitive
< 8 lbs./1000 ft2/ 24 hrs. for MVER or 90% to 95% RH	Between 7 < 9	V-Notch Trowel	Not Required.	Not Required.	Pressure Sensitive
> 8 lbs./1000 ft2/ 24 hrs. for MVER or > 95% RH	Less than 11	V-Notch Trowel	Not Required.	Moisture Barrier Required	High Moisture Resistant Adhesive
Moisture condition other than above.	pH Level other than above	Contact Carpets Inter for specific advice	Contact Carpets Inter for specific advice	Contact Carpets Inter for specific advice	Contact Carpets Inter for specific advice

We therefore confirm to have proven confidence in the performance of EcoSoft® backed carpet tile to be installed as specified onto a Wet or Green slab with up to 95% RH and a pH of less than 11. The advantage with EcoSoft® backing is that there is no need to apply an expensive concrete moisture barrier, burnish or grind the slab prior to installing EcoSoft® Carpet Tile.

Please note that the temporary application of a non-breathable protective film onto newly installed floorcoverings prior to site handover will expedite the problem of moisture entrapment and are not recommended by carpet tile manufacturers.

Wet slab failures will normally occur within the initial six to twelve months from installing the applied floor-finish and are the cause of inevitable conflict between Architects, builders, contractors, flooring and carpet installation contractors, building owners and critically the building occupant who is most affected both personally and financially if it impedes and/or prohibits their business operations. This

issue is not confined to just one country; indeed, it is the cause of significant litigation in many parts of the world, especially the U.S.

For more information on the unique performance benefits of EcoSoft® PET recycled backing, please review <https://www.carpetsinter.com/ecosoft>. We thank the people that have given time to review this paper, shared information, and provided insights to the problem of wet/green slab related flooring failure.

*Originally prepared June 2011.*

*Rev:1 May 2013 by Tim Preston, sustainability consultant and Above Left Pty Ltd.*

*Rev:2 June 2020 by Carpets Inter Technical Dept.*