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Education
Indoor Air Quality



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Flooring selection and its implications on indoor air quality

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Since the average person spends about 90% of their time indoors, indoor air quality plays an important role in the overall health (both short-term and long-term) of building occupants. For children, the effects can be even more critical as their growing respiratory systems are more sensitive to poor indoor air quality.

Adverse health conditions associated with poor IAQ can range from cough, eye irritation, headache, and nausea to allergic reactions, carbon monoxide poisoning, and severe asthma attacks. The leading cause of school absenteeism due to chronic disease is asthma. In addition, poor IAQ promotes the spread of airborne infectious diseases. Poor indoor air quality in schools aids in decreasing a favorable learning environment for children, contributes to loss of productivity by teachers and staff, is costly to resolve, generates negative publicity, strains relationships between the school and parents, and can facilitate adverse health conditions.

SOURCE: Indoor air quality in schools: Improving the air our children breathe
Environmental Public Health Leadership Institute, Toni Herring Bounds, PhD, MPH

We at Tandus Flooring take our role in the process of providing a healthy learning environment very seriously. Our mission is to help educators, facilities managers and design professionals provide the best environments for engaging children and inspiring them to learn.



Volatile Organic Compounds (VOCs)

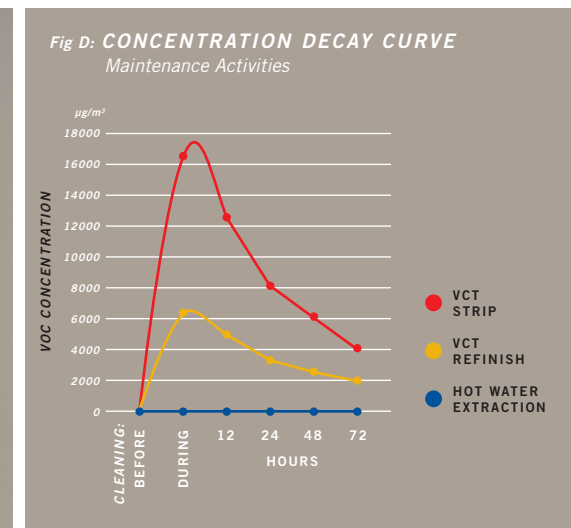
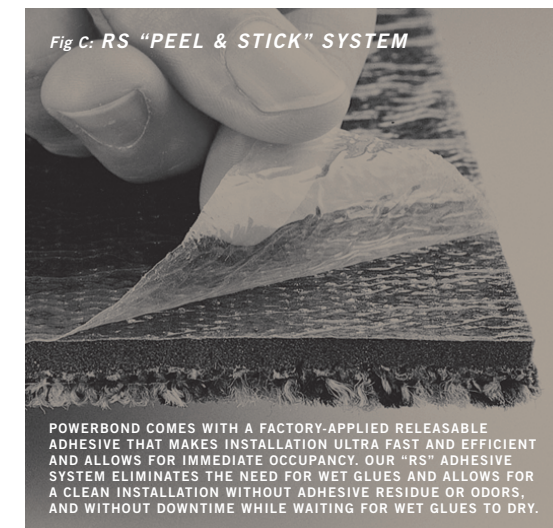
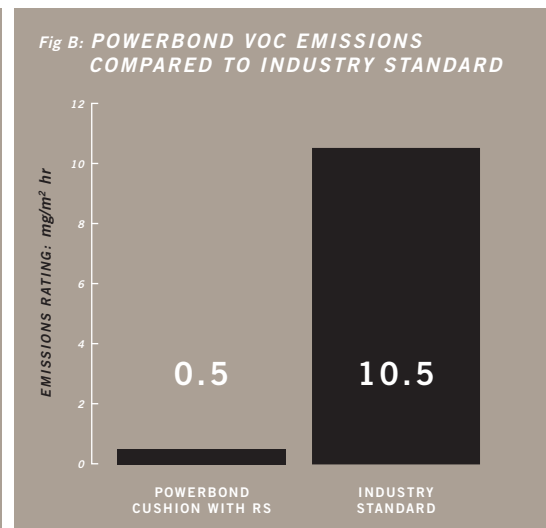
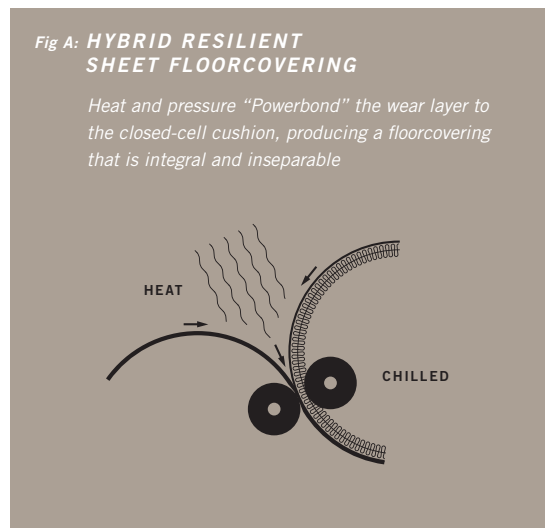
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VOCs are closely linked to interior finishes because of off gassing from the coatings and adhesives that are commonly used in furniture and millwork, wall coverings, paint, and floorcoverings. For floorcoverings, the release of VOCs is often most associated with wet glues used for installation and the ongoing maintenance procedures (stripping and burnishing) required for vinyl composition tile (VCT) flooring.

Powerbond® Cushion (Variable Cushion Tufted Textile – VCTT) revolutionized the flooring industry when introduced in 1967. **Powerbond is not carpet.** Powerbond is a hybrid resilient sheet flooring, heterogeneous construction of nylon and closed-cell cushion. Heat and pressure “Powerbond” the wear layer to the closed-cell cushion, eliminating the need for volatile chemicals during manufacturing. **Powerbond Cushion does not require additional curing or off-gassing once installed and does not demonstrate an emission decay curve associated with other floor products.**

The Revolutionary System (RS) further changed the industry in 1983 as a “peel & stick” installation method for Powerbond Cushion and was the first in the industry to eliminate the need for wet glues. This Revolutionary System (RS) of installation allowed Powerbond Cushion to be installed in schools 24/7 without the need for off-gassing. When compared to the industry standards for carpet with adhesives, **Powerbond Cushion with RS has twenty times less Total Volatile Organic Compound (TVOC) emissions than allowed for carpet alone.**

Because of relatively simple and inexpensive maintenance procedures that minimize the use of cleaning chemicals, Powerbond Cushion compares favorably against VCT. Maintaining VCT is not only extremely water intensive (a natural resource) but also requires the extensive use of chemicals (waxes and stripping agents) which can result in high levels of VOCs.



Powerbond is fiscally responsible

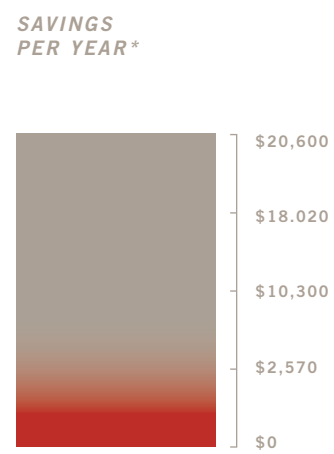
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Maintenance procedures for Powerbond are amazingly simple and cost effective.

Regular vacuuming along with interim low moisture maintenance and occasional wet extraction has proven to preserve the appearance of Powerbond Cushion for decades. Powerbond Cushion is constructed for low to extreme traffic conditions in schools and is well suited as an alternative to broadloom carpet, modular carpet and VCT in classrooms. The use of Powerbond Cushion in schools can significantly reduce the man-hours and expenditures associated with VCT making Powerbond Cushion a fiscally responsible alternative to traditional thinking that VCT is “easy” to maintain.

PERCENT HARD SURFACE		PERCENT POWERBOND		MAN-HOURS PER YEAR
10%	+	90%	=	3,767
20%	+	80%	=	4,025
50%	+	50%	=	4,797
80%	+	20%	=	5,570
90%	+	10%	=	5,827

NOTE: BASED ON 100,000 SQ FT FACILITY



*BASED ON \$10/MAN-HR



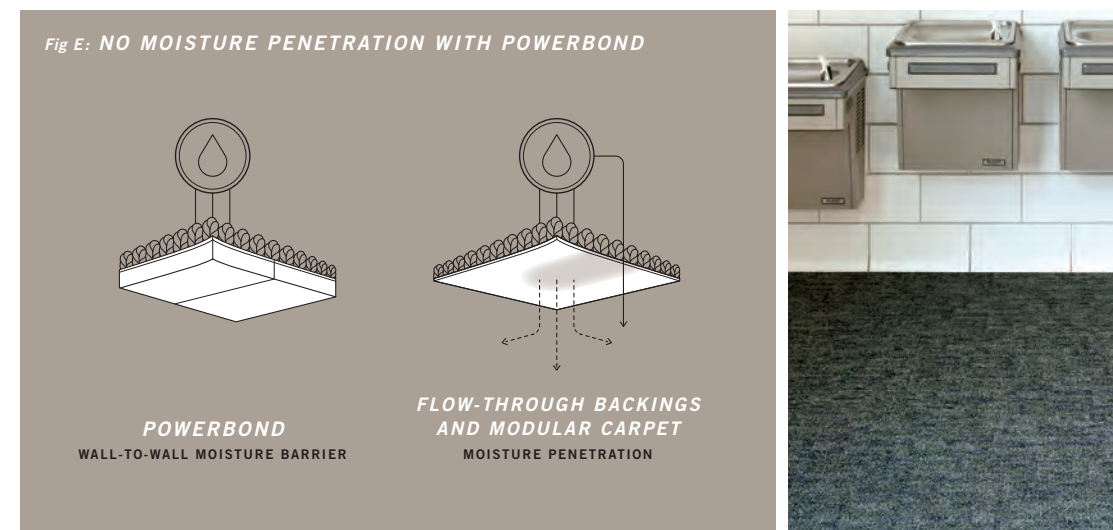
Moisture Management

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For schools, the most common culprits to moisture intrusions are leaks, floods, spills and maintenance. We don't normally consider maintenance as a culprit for moisture when maintaining hard surface, but it is a common consideration for broadloom carpet and carpet tile. The disconnect for carpet and moisture management is the propensity for these floor products to allow moisture to flow through the products at the seams or even the field areas. Rightfully so, this issue of "flow through" creates concerns for schools since dry times are increased and moisture below the surface of the floor creates moisture related health concerns. More importantly, carpeted floors by design hide seams so that even an exposed seam for moisture and microbial penetration is not obvious. However, these open seams are as big as the Grand Canyon to contaminants.

If VCT is used, the challenge is to control the moisture that typically penetrates between the tiles. VCT requires constant maintenance with five to seven layers of "wax" to provide resistance to water. Although waxing the floor creates a moisture barrier, as the wax wears off, dirt and moisture penetrate the seams between the tiles creating a perfect environment for bacterial growth. The use of modular carpet presents the same challenges of dealing with moisture penetration at the seams. A typical classroom will have over 900 linear feet of open seams when carpet tile is installed. Therefore, "flow through" floor products should be restricted to administrative areas and libraries where the incident of moisture related issues is greatly reduced.

Only Powerbond Cushion and floor products that create a wall-to-wall moisture barrier can properly manage moisture in schools. There is no substitute.



The Indoor Air Quality Consortium, an independent group of IAQ experts, recommends a closed-cell cushion backing as the first line of defense to control and improve IAQ in schools. In addition, to insure impermeability, the Consortium recommends that all products considered for installation pass the "Moisture Penetration Impact Test."

To pass this inspection, products are considered moisture impermeable after 10,000 impacts at the seams.

SOURCE: From the ground up: Floorcovering recommendations from an IAQ consortium, IssueTrak — CEFPI brief on educational facility issues

With impermeable construction and molecularly welded seams, Powerbond provides a wall-to-wall moisture barrier that prevents liquids from penetrating through to the floor. Because it is essentially waterproof, the liquid remains on the surface where it can be easily removed.

Moisture Management

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From below, moisture vapor emission rates (MVER) from concrete slabs can also create IAQ concerns. Moisture from slabs when combined with a food source and air can create microbial growth and odors. The misconception is that moisture is under “pressure” and is looking for an escape valve. This is not true. Moisture barriers at the slab allow moisture to reach equilibrium in the slab and are mitigated from entering the room. Almost all floors require the MVER to be below 3 pounds of emissions. Powerbond Cushion can be installed with the MVER up to 10 pounds and mitigate the moisture from entering the room.

A construction myth supports the notion that the floor product should “breathe” and allow moisture to pass through the product and allow the concrete to dry. This myth is supported by manufacturer’s who cannot provide a moisture barrier and projects that fall behind schedule looking for a quick fix. Moisture in old slabs may even be geological and reoccur on a regular basis.

The solution is simple. Provide a moisture barrier that works.

Here are critical questions to ask when researching impermeable flooring for classroom applications:

- Does the floor product provide cushion to support seam integrity?
- Are the seams permanently sealed and pass the 50,000 cycle chair caster test for seam integrity?
- Will the seams pass the 10,000 moisture penetration by impact test (3rd party tested)?
- Are references available from schools with product in class rooms for more than 25 years?
- When the product is repaired or replaced, does it maintain a wall-to-wall moisture barrier?
- Can the product be installed up to an MVER of 10 pounds?

Fig F: VAPOR EMISSION GRADIENT CAUSES MOISTURE TO RISE



Airborne Particulates

One of the most pressing concerns for school planners today is dust and airborne allergens. Allergens begin as airborne dust and particulates but quickly fall to horizontal surfaces and the floor. If they can be contained at the floor level until removed, the concern to air quality is minimal. **With VCT and other hard-surface flooring, allergens are continually “kicked up” by open doors, HVAC systems and foot traffic.** Once contaminants are airborne, they can enter the breathing zone, land on clothing and other horizontal

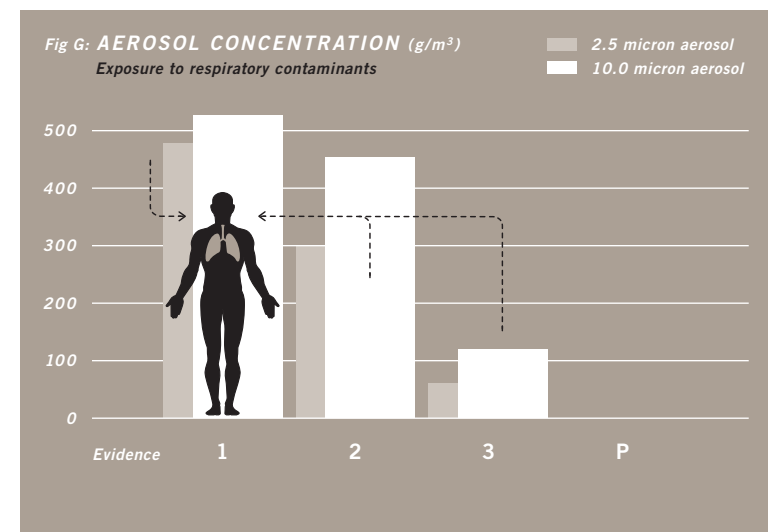
surfaces that become closer to the breathing zone of students. Regular maintenance of hard floors was once thought to reduce airborne contaminants because of a common misconception that shiny floors are clean. Tennis balls used to protect VCT from marring by chairs and table legs is anecdotal evidence that shiny floors are not clean by evidence of the debris trapped by the fibers. Mopping VCT is also considered “cleaning”. This would be true if the water were replaced after each classroom

as it is for hospital patient rooms. Unfortunately, the same water is often used throughout the school and suggests that dirty water is simply moved around from room to room. Many of these unchecked maintenance practices raise questions about cleaning in schools and their actual benefits. **Research conducted by the H.L. Turner Science group disproved that routine maintenance of VCT was keeping the school clean.** From simple sweeping and mopping to burnishing, these practices

“aerosolize” microscopic contaminants into the respiratory zones of children and occupants. Measurements were taken at 2.5 and 10.0 micron levels and indicated that when state-of-the-art burnishing equipment (with dust collectors) was used to “shine” VCT, this practice generated enough dust to be a concern to the operator and occupants. With its low nylon wear layer, Powerbond creates an effective trap for particulates and holds

them until vacuumed. New evidence supports that all classroom floors, regardless of type, should be vacuumed. The work conducted by The H.L. Turner Group caught the attention of The University of Tulsa Indoor Air Quality Research Program under the leadership of Dr. Richard Shaughnessy. Their initial interest focused on the relationship of airborne (respirable) contaminants between “flow through” carpet and VCTT (Powerbond) in schools.

- Their research supported three conclusions:**
- 1) Lab tests results of new flow-through carpet is not equal to the same results as carpet in actual classrooms;
 - 2) VCTT performs the same in lab tests as it does in actual classrooms;
 - 3) Flow-through carpet in classrooms creates 2 to 5 times more airborne contaminants when walked on than Powerbond.



BURNISHING VCT

- 1 / A state-of-the-art, battery-powered 2,500-RPM device
- 2 / A new plug-in 1,500-RPM unit
- 3 / An older plug-in 1,000-RPM device

New pads were used for each test

All burnishing devices were utilized with a manufacturer-supplied dust collector bag

P / Powerbond needs no burnishing and traps airborne particulates



Airborne Particulates

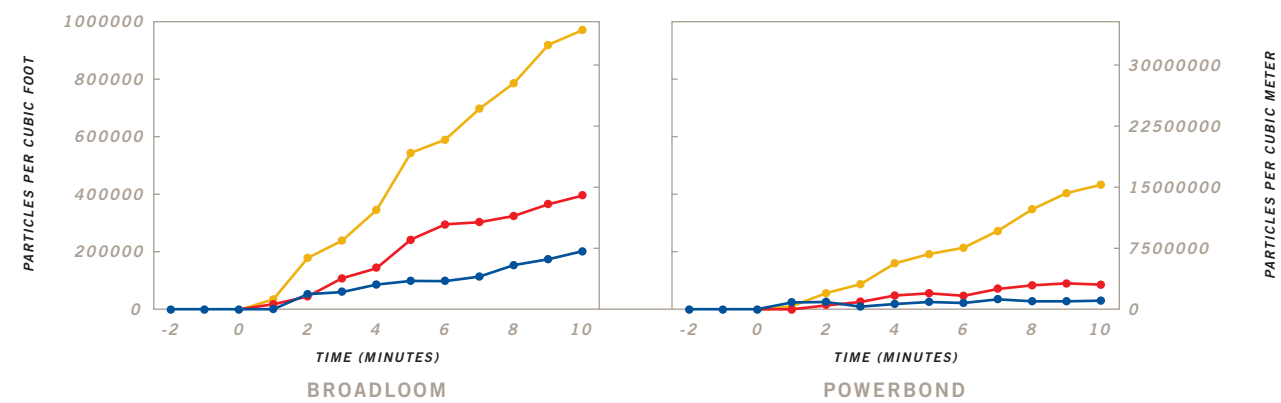
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Active movement on all floors re-suspends small particulates into the air. These particulates are respirable and can become triggers for allergy and asthma symptoms. This phenomenon is called the “pig-pen” effect. Flow-through carpet actually creates unexpected levels of the pig-pen effect at all particulate loads. Powerbond holds contaminants out of the breathing zone at all load levels tested and only becomes measurably airborne (150 grams/meter) when the particulate is visible on the Powerbond surface.

Fig H: RE-SUSPENDED PARTICLES

SOILING LOADS IN BROADLOOM AND POWERBOND:

50 g/m² ● 100 g/m² ● 150 g/m²* ●



Source: University of Tulsa,
Indoor Air Quality Research Program

* Load level not typical in Powerbond



Innovative IAQ Research

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The elevated airborne particulates of flow-through carpet compared to VCTT were considered significant.

This study led The University of Tulsa to further study the effects of VCTT (Powerbond) compared to VCT in classrooms. Preliminary findings of this study measure and compare the amount of settled dust in actual classroom environments that have VCTT and VCT flooring. The data shows that classrooms with Powerbond have 25% less settled dust than classrooms with hard surface flooring, and this is considered significant.

As a result of these findings research continues.

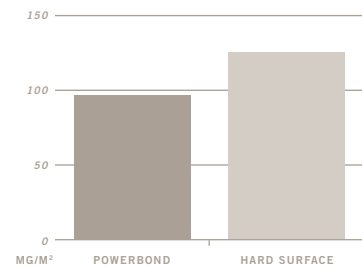
Settled dust creates IAQ concerns for several reasons:

- Settled dust accumulation related to sick building syndrome (shelf factor)
Skov, Valbjorn, Danish Town Hall Study, 1987
- Symptom reports correlated to settled dust content (bacteria, fungi, allergen)
Gyntelberg, 1990

Once re-suspended, the particulates circulate in occupant breathing zones and eventually settle on other horizontal surfaces such as window blinds, book shelves and other furniture. A floor that can hold onto floor contaminants until mechanically vacuumed creates less concern for IAQ during active periods in a classroom and corridor. And a floor that helps to reduce settled dust in classrooms allows floor maintenance to be more productive and less susceptible to particulate build up on surfaces closer to a student's breathing zone. Taking these two issues into consideration, Powerbond supports a healthier indoor environment.

Every aspect of classroom design should be taken into account before you make final decisions, as those decisions will directly affect the future of our students and the wellbeing of your staff.

Fig 1: AVERAGE MASS COLLECTED PER MONTH (MG/M²)



Tandus Flooring is proud to offer solutions that enhance places where we live, work, learn and heal. For more information on how Tandus Flooring can help you make your classrooms a success, please contact your local Tandus Flooring Account Executive or visit tandus.com



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Indoor Air Quality

No. 4 in a series