CFR The Commercial Flooring Report
For the Commercial Floor Covering Industry
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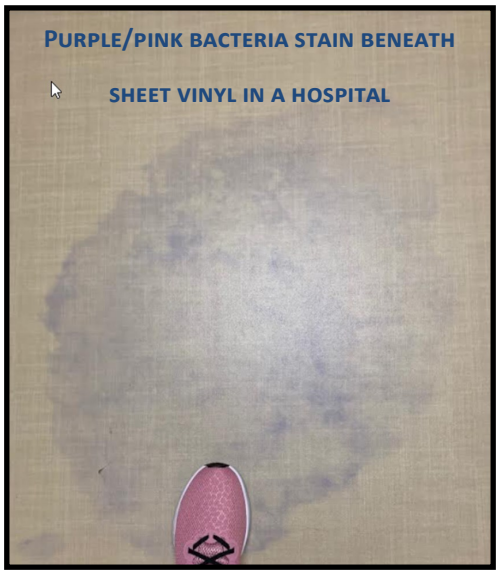
Stained Vinyl Flooring



Over the last three weeks we've been contacted three times regarding projects that are experiencing staining on vinyl composition tiles and vinyl sheet goods. The stains range from pink/purple to blue. We're talking about stains that occur beneath the flooring that discolor the surface of it. Not agents that have been spilled on the surface to stain it.

Any contaminant on the concrete substrate such as ink, paints, foreign substances from construction, chemicals migrating from the concrete substrate or bacterial growth, mold and mildew, can stain vinyl flooring and particularly sheet vinyl. In addition, installing vinyl flooring over OSB or Luan, both of which contain materials that can affect vinyl flooring and chemicals that may stain it, should be avoided.

For background on this subject, most of the vinyl discoloration issues occur in the vinyl upholstery industry, and that's where most of the studies have come from to identify the causes, but they'd be very much the same for vinyl flooring.

Vinyl flooring stains are not a new phenomenon, most of you working with or selling this flooring have likely encountered vinyl staining. I remember looking at staining in sheet vinyl back in the 1980's. We had a particular issue at that time with vinyl flooring installed in modular homes that was plagued with purple stains. The staining was attributed to the underlayment being used beneath the sheet vinyl flooring. We worked with the provider of the sheet vinyl to correct these issues around the country. Fast forward to today where imported sheet vinyl flooring is made with compounds that may be different than domestically produced vinyl. What you get in products made in the US may be very different than products received from other parts of the world. Be aware also that cost in the product is always under scrutiny to lower prices. With the issues that have plagued all manufacturing industries today, that is getting components to produce finished goods, shopping for replacement materials and chemicals may result in getting something no one bargained for that could compromise the product down the road. I have no doubt we'll be seeing the results of material supply and chemical component issues in the future.

There are several causes of discoloration in vinyl flooring. These can be mold, mildew, a breakdown of the PVC and the interaction of additives in PVC formulations. Also, the interaction of the PVC substrate itself with other types of substrates, such as concrete, gypsum, OSB or Luan, when chemicals between the two substrates migrate under various conditions creating the reaction that causes the discoloration.

Staining in the flooring usually takes time to develop when a reaction takes place between the cause and the result, and it can be small in the beginning, grow or stay isolated to one location where the reaction takes place.

The discoloration can be mild to severe, depending on several factors including the age of the vinyl. The time it takes for the discoloration to show varies by situation, it can occur gradually, over a period of time, or it can happen very quickly after installation.

Causes of the color

While the discoloration of sheet vinyl flooring is not uncommon, it is also not a big issue, but it does occur and has for decades. It is not unique to the flooring industry either. The discoloration phenomenon occurs in automotive vinyl applications, vinyl siding, windows and door trim. And it has occurred across a variety of coated, laminated, rubberized and water repellent fabrics. Vinyl discoloration can occur in several colors, including yellow, orange, blue and pink.

Studies show the discoloration issue is related to chemical reactions from trace amines migrating into the vinyl and reacting with compounds (such as phthalates, which are used as plasticizers) in the vinyl to produce a colored compound. Since the discoloration is due to a chemical reaction within the vinyl, which impregnates it, trying to clean it is futile. If the staining is on the surface, using bleach to treat it may help, but it may also hurt the vinyl. The discoloration may be lessened but it won't be totally removed, and it is most likely to come back.

Most often the occurrence of random pink or purple stains are caused by a dye that originates from bacteria beneath the vinyl flooring. The dye is produced by the bacteria. These same bacteria are most likely the cause of the problem, especially if moisture is being trapped under the flooring. Pink stains aren't the only types of stain that can occur on vinyl.

Orange to rust colored spots may appear and are attributed to mold and mildew that can also produce stain causing pigments.

Bacteria could be growing on the subfloor with the dye migrating upwards over time, causing the mysterious pink stains on the vinyl floor to magically appear.

THE COMMERCIAL FLOORING REPORT

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Other Causes of Discoloration

Placing rubber mats or foam rubber mats on the surface of the vinyl can also discolor it.

Moisture and alkalinity, the alkalinity being the culprit, can also stain vinyl flooring. Sheet vinyl flooring glued to the substrate is most susceptible to discolorations from substances or residual substances in or on the concrete. Remember that this is all chemistry. The chemicals in something that may be in or on concrete, or in the vinyl, can and will react when they are placed together or near each other. And you're not going to know what the chemistry is or was that created the problem. That can be determined by concrete core testing after the fact to correct the condition but unless you can see something on the surface of the substrate that is obvious, you're not going to know what caused the discoloration. BHT, butylated hydroxytoluene in rubber, which is used to mitigate decomposition of the material, can cause yellowing on the surface of vinyl flooring when the two come in contact. We saw a lot of yellowing of polypropylene Berber carpet years ago from the BHT in rebond padding. These discolorations are always the result of some chemical reaction or incompatibility.

Reaction with old adhesives, abatement chemicals and cut back adhesive can discolor from beneath the flooring. Asphalt tracked in and onto the surface of vinyl flooring, especially with soft soled shoes which can absorb a chemical discolorant and deposit it onto the surface of the vinyl flooring, will discolor it. The lighter color the vinyl flooring is the more discolorant will be seen in it. Darker colors will hide more, but the discoloration will still be seen.

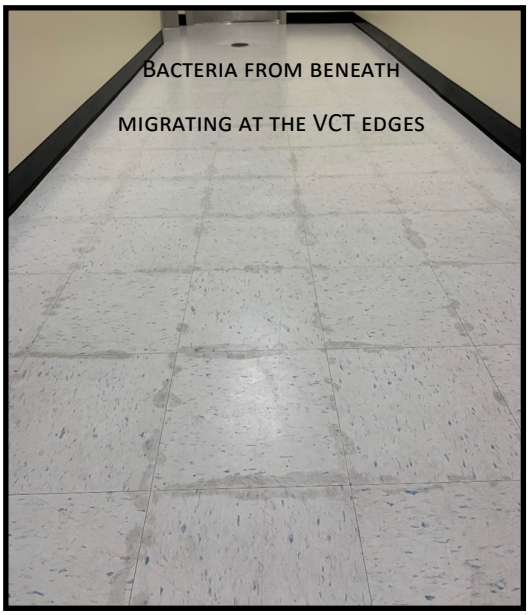
All sheet vinyl products are susceptible to discolorations and most of these products are affected by discoloration from the bottom-up.

The following are some of the causes of bottom-up discoloration. Hopefully, this information will help you identify potential causes of these problems and help avoid them or determine what they are:

Adhesives: In an attempt to save money installers and/or retailers may choose an adhesive not recommended for use under resilient materials. Caused by antioxidant or processing oil ingredient in the adhesive,

this discoloration will be yellow and appear in various shapes and sizes. I'll add, again, that with the supply chain for all components going into flooring and adhesives being tight and the costs escalating, there may be chemicals going into these materials that may not have been used before. My concern is that we may see some ugly issues arise because of this, in both adhesives and the flooring products themselves, that may not only cause discoloration issues but product integrity and performance issues as well. Let's hope I'm wrong.

Alkali Discoloration: Associated with moisture migration, alkaline salts in the concrete travel with water vapor and attack the printing and PVC components of resilient material. This alkali attack bleaches out the material and gives the floor a milky appearance.



BACTERIA FROM BENEATH MIGRATING AT THE VCT EDGES

Bacterial Discoloration: Already mentioned, but mold and mildew, which are also associated with moisture migration, appear to be bluish-gray to black in color. Promoted by an accumulation of stagnant moisture, micro-organism growth produces a spot that will continue to expand. When the wear surface is removed, the backing will have a pungent, musty odor and the backing will feel damp.

Construction Adhesives: Some construction adhesives contain an antioxidant known as butylated-hydroxyl-toluene (BHT) which has been known to off-gas up into the material and cause a yellow discoloration. This often surfaces as spots where the gas from the adhesive migrated up around nail heads or in straight line above the underlayment joints. Sometimes, it mirrors the pattern of the adhesive application straight over the floor joists and swirled beneath underlayments.

ASPHALT TRACKED IN ON VCT TILE AND DISCOLORING IT—NOTICE EDGES

Fungal Discoloration: Fungal activity requires three components: a fungi spore, which is present virtually everywhere; a food source, which can be found in some gypsum-based products (i.e. taping compound, wall texture overspray and some gypsum patching compounds) and excessive moisture. This discoloration is often found over concrete and gypsum substrates that are too wet to install over. The discoloration is pastel-pink, blue, green, blue, and yellow or tan-colored spot that grows larger over time.

Patching compounds and embossing levelers: Installation of resilient materials over un-dried patching compounds and embossing levelers can create either a bacterial or fungal discoloration, often yellow or gray in color.

Residuals on the surface of the substrate: Many reagents cause discoloration and/or damage to resilient materials from beneath. Among the culprits are:

- Adhesive Residues – cutback (asphalt) and latex (SBR based)
- Concrete Markers – Spray paint, felt tip markers and wax marking crayons
- Equipment Leaks – oil and grease
- Painting Products – Paint thinner, mineral spirits, oil-based stains, and paint spills
- Roofing Tar and Other Asphalt Products - drive way sealer
- Adhesive Removers – oil, solvent and citrus based
- Concrete Waterproofing Sealers – oil or solvent based
- Heating Products – kerosene, diesel and heating oil
- Plumbing Residues – PVC pipe primer, oil from threading machines and oil residues from pipe.

Solvent attack: Installation of resilient materials over a recent solvent spill permits solvent to migrate up into the material where it distorts the material's surface that diffuses light differently. This usually creates a dull spot.

Underlayment edge treatments: Some wood panels used for underlayment are treated with a preservative or sealer on the edges of the skids. Some of these edge treatments contribute to debonding, discoloration or both. Rarely are these products designated for underlayment usage. This type of discoloration is generally in a straight line directly over the underlayment joints.

Underlayment fasteners: Often underlayment fasteners will promote resilient discoloration that appears as yellow spots. This problem is the result of one or more of the following:

⇒ BHT migration – Discoloration is caused by off-gassing of BHT found in construction adhesives

⇒ Coated nails (sinkers) – Sinkers which are not a proper fastener for underlayments, are a leading cause of floor discoloration. The anti-rust coating on the nails, usually gold or black in color, will off-gas up into the material and affect both felt- and vinyl-backed materials. Most sinkers can be identified by their diagonal checkered pattern on their heads

⇒ Coated staples – as with sinkers coating on some staple fasteners will also affect resilient products. In this case the discoloration is either pink or tan

⇒ Oil residue from pneumatic nailer or staplers – During use, over-oiled, worn out or poorly maintained air driven fastening equipment will often spit a small residue of oil onto the substrate. This residue migrates up into the material and creates a yellow spot in the material

⇒ Rusty fasteners – Excessive moisture in the substrate will allow fasteners to rust creating a reddish-brown discoloration

Foreign matter in wood underlayments: Occasionally, foreign wood chips get into the mix used to make oriented strand board (OSB) or waferboard underlayment. These chips can cause discoloration. Red cedar and redwood chips will leave a reddish color. Chips that contain creosote and pitch will leave a yellowish color and chips from bark and pinecones will leave a brownish discoloration. It is extremely difficult to determine which chips will cause discoloration. Even worse, no one wants to accept responsibility when the problem occurs. Best way to avoid problems here is to never install sheet vinyl over OSB or Luan. You have no idea what may be in this stuff, especially if it comes from overseas.

Wood filler (plastic patch): Plywood manufacturers that use synthetic wood filler must exactly mix the patching compound components to the specified portions or the filler may off-gas and migrate up into the resilient sheet material where it leaves a yellow discoloration that mirrors the shape of the synthetic patch. Over time the patch will shrink and create a show-through problem, as well.

Remember that every manufacturer of flooring materials and adhesives will state that the substrate must be free of moisture, dust, sealers, paint, curing compounds, parting agents, residual adhesives, adhesive removers, hardeners, resinous compounds, solvents, wax, oil, grease, asphalt, gypsum compounds, alkaline salts, excessive carbonation or laitance, mold, mildew, any other extraneous coatings, films, compromising materials and all other foreign matter. And always be leery of installing over Luan and OSB.

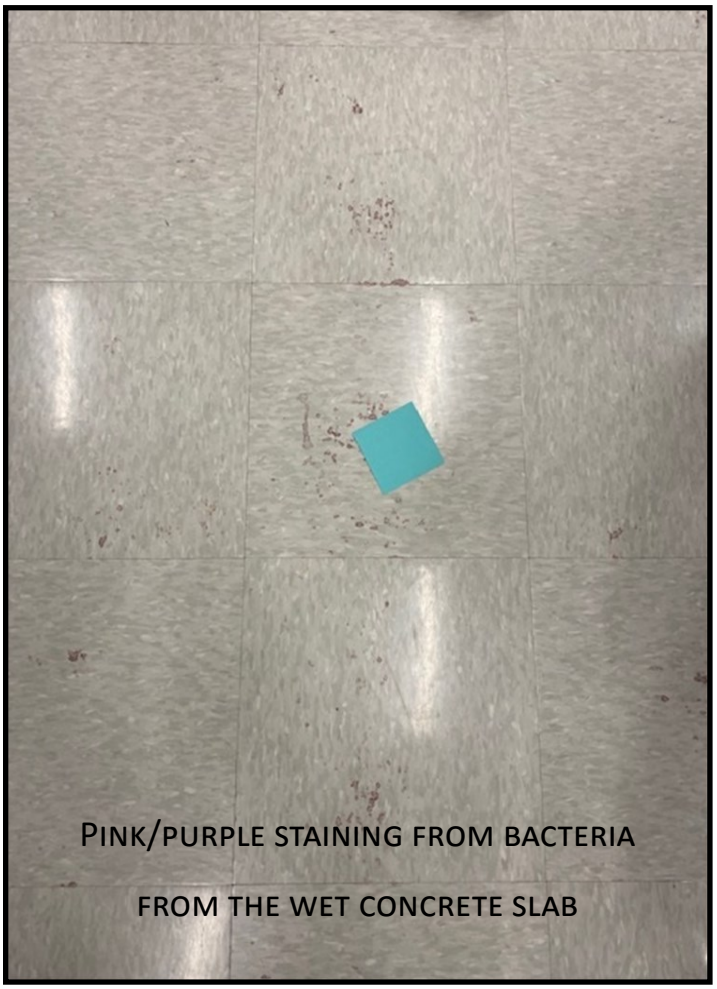
Hopefully, the information presented here will help you identify potential causes of discoloration and remove them. Just make sure that you closely examine the substrate for anything that looks like it will compromise your installation, or the material being used. And don't forget that someone may have added something to the concrete substrate that could cause a problem.

Even then, there are many undiscovered causes of discoloration that lead to complaints. Resilient manufacturers have made great strides to help eliminate bottom-up discoloration. The installer and flooring contractor need to be aware of these concerns. But the general contractors also need to be accountable for using the right products and protecting substrates from possible reagent exposures prior to the start of the installation. When in doubt, stop and ask questions so you don't step into the slop on a project and get yourselves in trouble. Remember, the act of installation constitutes acceptance of the conditions in the eyes of the law. That makes the flooring contractor and installer liable for the problem from which you'll have to defend yourselves. Not fun, or cheap, regardless of the outcome.

We've included several pictures of flooring discoloration as examples of recent jobs affected by various causes.

If you need help, information, or answers to your commercial flooring questions, contact us. That's what we're here for, to help you stay out of trouble and to ease the pain if you get into it.

I want to thank Ray Thompson and Tim McAdoo for contributing information to this issue of the CFR newsletter.



PINK/PURPLE STAINING FROM BACTERIA FROM THE WET CONCRETE SLAB

STAINING FROM MOISTURE IN THE SLAB DISCOLORING THE WELDED SEAMS IN THE SHEET VINYL

Learn the latest residential and commercial flooring and design trends from nationally recognized design leaders during a free webinar hosted by the Floor Covering Institute. The panel participants include: Amber Cagle, Owner of Black Dove Interiors, Emily Morrow Finkell, CEO of Emily Morrow Home and Lauren West, Director of Global Color & Design at Sherwin Williams. The webinar will be moderated by Mark Boldizar of the Floor Covering Institute and it will be held at 11 am EST on April 5th, 2022. To register for this Zoom webinar, go to: FCI Design Trends in Flooring Webinar

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