Is pH a Concern for Floors?

In general the flooring industry believes “concrete moisture related” floor failures are due to high moisture vapor emission rates (MVER) and/or moisture content. In 1996, our research found there was no correlation between moisture levels and moisture-related failures. This opinion, while unpopular at the time, has since been substantiated industry wide. Alkalinity plays a major role in flooring failures.

The role alkalinity has played in flooring problems has not been as neat and easy as we would like it to be. For instance, we have seen floors totally fail with a pH of 11.0, while another floor tests at 13.0 and never has a problem. With this information, you might conclude there is not necessarily a correlation between elevated pH and flooring problems. In general you would be right.

What is pH? Simply put, pH is a measure of how acidic (low pH) or alkaline (high pH) a solution is. A pH of 7 is neutral. Healthy concrete has a high pH (12.0 –13.3).

Where does alkalinity in concrete come from? Alkalinity forms as a result of Portland cement reaction with water. The excess (alkaline saturated) mix water moves towards the surface forming capillaries throughout the concrete. As the concrete “dries out”, calcium hydroxide remains inside these capillaries.

How does this affect flooring? When a low or non–permeable floor is installed over the ‘breathing’ concrete, vapor can now collect and condense under the floor. Since vapor cannot carry anything with it, moisture that forms under the floor is pure water. Pure water is attracted to the salty water in the concrete. This allows the alkalinity to mix with the pure water and accumulate at the floor bond line.

Will this cause the floor to fail? Currently there is no certain way to predict damage. It all depends on how much alkalinity can move towards the surface. This is where it is important to understand the difference between pH and alkalinity. If you add a small amount of alkaline salt to water, it will raise the pH but may be no more harmful than tap water. If a lot more alkaline salt migrates directly under the flooring material, the pH may not rise any further, but it will now be a caustic solution that becomes more damaging as the concentration increases.

Determining how to test prior to installing a floor covering or coating is important but can also be confusing. Testing for alkalinity falls into this category. You can test for pH, but there is no accepted method for testing for alkalinity in the field.

For new concrete, you may find an “alarmingly” high pH (11 – 13.5). This is normal and should be expected. If there is a curing agent, bond breaker or contaminants on the surface, the pH will generally be 6.0 – 8.0 which indicates the concrete has not been properly prepared. The pH level in this case rarely equates to alkalinity.

In the rare cases where the concrete has been water cured or exposed to weathering for several weeks, and sometimes years, the surface pH may be 8.5 – 9.0. This would appear to indicate a safe surface for installation of a floor or coating. However, there is no way to know if damaging levels of alkalinity will migrate to the surface after low-permeable flooring has been installed.

In most cases when a floor fails you will see moisture. How do you know if it's a moisture or alkalinity problem? There are some basic ground rules.

If the floor "fails" within a month of placement, this generally falls into the moisture-only category and is usually caused by excess environmental moisture (dew point), early floor placement, or high MVER affecting the adhesive cure.

Problems that occur later and especially after 6 months or more will generally fall into the alkalinity category. Some of signs of alkalinity damage are:

- Adhesive randomly becomes soft or re-emulsifies.

- Epoxy coating or epoxy adhesive bubbling occurs, with a solvent-like odor.

- Crystallized (dried out) adhesive is visible.

Testing these areas with pH paper can quickly confirm alkalinity damage. If there is a rapid color change to the paper, it usually indicates alkaline concentration.

The purpose of this article is to raise awareness. Each topic touched on here could be an article in itself since so much confusion still exists as to what constitutes "safe" levels of moisture, pH and alkalinity. It is our hope that better understanding will lead to better decisions.

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