

# Indoor Environment CONNECTIONS™

The Newspaper for the IAQ Industry

www.ieconnections.com

Volume 7, Issue 10 • August 2006

## Old Test Methods for Moisture in Floors Replaced

**Christopher Capobianco**  
**Owner**  
**Flooring Answers**  
**Patchogue, N.Y.**

With the ever-increasing awareness of indoor air quality issues, especially in schools, moisture in many forms is a concern because of the effect of moisture on mold and bacterial growth and odor. Construction managers, IAQ professionals and engineers are increasingly being asked to investigate problems related to odors or mold, and restoration specialists may be called on in jobs related to water damage. Knowledge of the causes of these moisture-related problems in interior finishes and how to test for them is required in

today's sensitive environment.

Moisture-related problems in concrete slabs continue to be a concern on a variety of levels including indoor air quality issues, and this is still a misunderstood issue throughout the construction industry. Moisture trapped between a flooring product and a concrete slab can cause adhesive to ooze between the seams, creating maintenance and odor problems, or can cause the adhesive to let go altogether, creating tripping hazards when tiles pop off the floor or when a floor bubbles. Even worse is when the moisture is not severe enough to cause these visible problems but is sufficient to create a fertile breeding ground for mold, mildew or other microbial growth beneath flooring materials or in the lower portions of walls.



*Floor tiles are prone to cracking in severe moisture conditions when the adhesive beneath the tile re-liquefies due to moisture emissions from the concrete.*

This article appears in Volume 7, Issue 10 (August 2006) of *Indoor Environment Connections* newspaper and is reprinted here with permission of the publisher.  
For subscription information, visit [www.ieconnections.com](http://www.ieconnections.com).

It is often said that moisture-related issues are less of a concern with carpet or vinyl composition tile, two common flooring materials in schools. However, this problem crosses all borders as far as flooring materials, and there are five potential sources of moisture to be aware of: water damage, outside sources of moisture, adaptive re-use, renovation projects and new concrete.

IAQ people often think of moisture issues in terms of buildings that have had flooding or other water damage. A dry concrete slab that gets wet again from a flood can take almost as long to dry as new concrete right out of the truck, so it is a very valid concern that concrete floor slabs be adequately dry before installing a new floor.

Poorly graded landscaping, sidewalks or parking lots can direct water towards a building, which can seep under a concrete slab and then come up through the slab in vapor form. Other examples of outside moisture sources are outside sprinklers that are not properly aimed, broken pipes beneath the floor, heating systems or parking lots with occupied space above them, and a variety of other sources of moisture that can cause water

vapor to move upwards through a concrete slab, leading to floor-covering failures or mold issues.

Older concrete slabs can be just as much of a concern as new ones as far as concrete moisture problems even if there has not been water damage, especially when the slab has never been covered before. With so many adaptive re-use projects going on today, spaces that were once bare concrete are now being covered with flooring, such as when storage areas are converted into classrooms. The point is that these slabs were originally designed to be left bare, so they may not have been constructed with a vapor retarder beneath the slab. Without a floor covering, this is not an issue, as moisture vapor passes through the concrete slab harmlessly. However, with a floor covering glued to the top of this slab, the moisture movement is blocked and becomes trapped between the floor covering and the concrete.

There is often an assumption that if there is an existing floor covering firmly in place, one should not worry about moisture issues because none is apparent. Some may suggest that the 50-year-old asphalt or vinyl asbestos tile in the school corridor



*By drilling into the concrete, the ASTM F 2170 method can measure internal moisture levels.*

This article appears in Volume 7, Issue 10 (August 2006) of *Indoor Environment Connections* newspaper and is reprinted here with permission of the publisher.

For subscription information, visit [www.ieconnections.com](http://www.ieconnections.com).

is “down like a rock” so they should just cover over it with the new flooring. The concern is that there may be some moisture movement through the joints in the existing floor that is not enough to cause bonding problems, but this movement can be blocked when a new floor is installed. Another factor is that with changes in floor covering product and adhesive formulation and construction, newer floors may be less permeable than the old ones, and the new water-based adhesives may be less tolerant of moisture than the older solvent-based formulations.

New concrete slabs, whether they are a below-grade basement installation, a first floor on grade slab, or a second floor suspended slab, take much longer to dry to a point of readiness for floor-covering installation than most people know. One laboratory study under ideal conditions (which are rare on today’s construction sites) found that a standard mix concrete slab took 46 days to dry to acceptable limits and a lightweight concrete slab took 168 days. This flies in the face of the “28-day cure” that everyone has heard about for years because curing and drying are two different things. Curing is the chemical reaction that bonds the ingredients in concrete together and drying is what happens after that when the excess water evaporates. With “fast track” construction projects being what they are, a new addition to a school that is begun in June needs to be finished by September, and the concrete is rarely dry enough when the flooring is installed.

So, how does one prevent moisture-related problems? The first step is detection! Regardless of the age or grade level, every concrete slab needs to be tested before any type of flooring product is installed. What follows are six methods for concrete moisture testing. The first three should never be used to make a decision about whether a concrete slab is ready to have a floor installed, while the last three are the latest ASTM standards.

The senses test poses that it looks dry, it feels dry, or it smells dry. However, you can’t see, feel or smell moisture coming out of a concrete slab, so this is not the way to decide if the floor is ready to be installed.

The plastic sheet test is the procedure of taping down a sheet of plastic and coming back a day or two later to see if it’s wet underneath. This has been used for many years, but the problem is that because of the effect temperature and humidity have on this test, “dry” results can occur even on slabs that actually test “wet” using other,

more scientific methods, and if you have a “wet” result, there is not way to know how wet it is.

Concrete moisture meters are a spot check, but they give no indication of long term moisture conditions and there are no flooring or adhesive manufacturers who will accept this method as a “go or no-go” test for installing resilient flooring over concrete.

The following three methods are ASTM Industry standards that have been developed to provide accurate and repeatable results.

The calcium chloride test method, ASTM F 1869 “Standard Test Method for Measuring Moisture Vapor Emission Rate (MVER) of Concrete Subfloor Using Anhydrous Calcium Chloride,” has been around almost 50 years and is widely used but often done incorrectly. The four most common mistakes when doing the ASTM F 1869 test are doing it under the wrong conditions (The building must be at the same temperature and humidity it will be when the space is occupied); not preparing the surface (A 20-by-20-inch square at each test site must be ground-cleaned 24 hours before the test is placed); not waiting (Failure to wait 24 hours may result in a false high reading); and not enough tests (Three tests for the first 1,000 square feet and one test per 1,000 square feet after that). Even when done correctly, the calcium chloride test has limitations because it measures moisture vapor emissions only from the very top of the slab and because most concrete slabs dry from the top down, they are often dryer at the top than on the bottom. Two other methods have been developed that are able to “look deep” into the concrete to see if there is any moisture waiting to come to the top.

The relative humidity “probe” method, ASTM F 2170 “Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using In Situ Probes,” involves drilling holes to 40 percent of the slab thickness – usually two to three inches down. This measures moisture inside the slab, which is thought of as a more accurate way of predicting what will happen in the future. This method is also less sensitive to fluctuations in ambient air humidity and temperature above the slab. A number of companies have developed the equipment to conduct this test.

The relative humidity “hood” method, ASTM F2420 “Standard Test Method for Determining Relative Humidity on the Surface of Concrete Floor Slabs Using Relative Humidity Probe Measurement and Insulated Hood” is a brand-new method in the United States that was published as

This article appears in Volume 7, Issue 10 (August 2006) of *Indoor Environment Connections* newspaper and is reprinted here with permission of the publisher.

For subscription information, visit [www.ieconnections.com](http://www.ieconnections.com).

an ASTM Standard in 2005. Like the ASTM F 2170 method, this test also measures relative humidity, but on the surface instead of inside a hole in the concrete. Like the F 2170 method, this method is not as sensitive to atmospheric conditions, unlike the calcium chloride test kits, and is gaining popularity because it requires no drilling. This method is so new that flooring manufacturers have not yet started to issue limits for moisture using this test, but readings from the hood method tend to be 5 percent lower than with the sleeve method.

How can you get trained on concrete moisture testing? Claudia Lezell, co-owner of the Flooring Technology Institute, a technical training and education center, has been involved with the development of training programs for inspectors for a number of years through her volunteer work as vice president of inspections for the Institute of Inspection, Cleaning and Restoration Certification. "The IICRC has developed a hard surface inspector training and certification program," she explained, "and the prerequisite course is Introduction to Substrate/Subfloor Inspections, a three-day course including a 160-question exam that is open to anyone who wants to learn this material, whether or not they plan to work as an inspector." There are a few schools around the country offering this training, and, Lezell said, "FTI offers the IICRC's three-day ISSI course and also our own one day course, Moisture Testing and Investigation Day."

So, now that you have determined that moisture levels are above the allowable limits, what is next? This is the time to consult with the floor-covering people to learn what the limits are for the flooring product and adhesive that are to be installed, and to learn what methods might be

recommended to mitigate the problem. It might be as simple as cranking up the heat and lowering the humidity in the building to dry the slab out or as complicated as bead-blasting the slab and applying an epoxy-based vapor reduction system and then a self-leveling underlayment. These decisions can be made with the involvement of the owner, the flooring contractor, the builder and often with some consultation from outside agencies. However, if the testing is never done and the flooring gets installed anyway, repairing these problems after the space is occupied is a lot more complicated and expensive.

*A fourth-generation floor covering specialist, Christopher Capobianco has a background including work as a retailer, architectural sales representative, technical support manager, consultant, writer, educator and activist. His company, Flooring Answers, provides training, technical support, trouble shooting and testing for architects, end users, flooring manufacturers, and other companies in need of an independent third-party to provide expertise in the area of commercial resilient flooring and the related issues including concrete problems. Capobianco has written for several industry magazines, including his current columns in National Floor Trends and Floor Covering Installer, and has spoken and conducted training at conventions and industry events such as Surfaces, the floor-covering industry's annual trade show. He volunteers as chairman of the FCICA, an association for flooring contractors; as a member of ASTM Committee F.06 on resilient flooring; and as chair of the Resilient Floor Inspector Committee of the IICRC. He can be reached by e-mail at [FlooringAnswers@optonline.net](mailto:FlooringAnswers@optonline.net) or by phone at (631) 275-6494.*

This article appears in Volume 7, Issue 10 (August 2006) of *Indoor Environment Connections* newspaper and is reprinted here with permission of the publisher.

For subscription information, visit [www.ieconnections.com](http://www.ieconnections.com).