FLOOR EVALUATION & GUIDELINES

Flooring problems on concrete from vapor emission, dew point, alkalinity; pH, etc. cause millions of dollars in repair and replacement costs annually. By recognizing potential problems, testing for and mitigating them, steps can be taken to ensure a long lasting, successful flooring installation.

What is Moisture Vapor Emission?
Water is added to turn cement, sand and aggregate into a concrete slab. There is a critical volume of water needed to "hydrate" the concrete and an excess volume of water used to make the concrete pour-able and workable. It is this excess that can emit from the slab. Moisture is also a concern when the concrete slab has no vapor retarder installed, or the vapor retarder has been punctured.

How does moisture move through the slab?
Capillary moisture: ground water touches the bottom of the concrete slab, and wicks into the concrete through microscopic bleeder water channels until it reaches the coating surface. As the water comes through the slab, it brings calcium/sodium salts with it that can degrade the bond line and cause the coating to delaminate.

Osmotic Moisture: actual water vapor transmission through the concrete slab condenses again at the bond line and causes the same problem as in the capillary moisture case. This can happen when the water table is far below the slab with an improperly installed or missing vapor barrier. Three conditions are needed for osmosis to occur: a semi-permeable membrane, which can be the polymer primer or the upper layers of the slab, a gradient of ionic activity (soluble salts, which are indigenous to concrete), and a source of moisture vapor. If any one of these three things is removed, osmosis cannot occur.

Hydrostatic: the surrounding water table is higher than the concrete slab on grade. Because water seeks its own level, it is forced through the slab under pressure. Both the pressure and the water cause the coating to delaminate.

The volume of moisture that can pass through a slab depends on the porosity of the slab. Porosity is a direct result of the water/cement ratio in the concrete mix design. As the water/cement ratio increases, the porosity of the concrete increases exponentially.

What is the traditional failure mode because of "moisture" problems? There are two ways a polymeric floor can fail: (1) the floor system was never able to bond properly at the time of installation or (2) there were factors present at the time of installation to cause the bond to fail. Symptoms of failure on an already installed floor may include bubbles, blisters and/or delamination.

What causes a polymeric floor to fail?
Traditional theory has focused primarily on moisture failure such as capillary and hydrostatic, however more recent research has found that although moisture plays a role, it may not be the only factor. In reality, the presence of ionic compounds in the concrete can also play a role. Specific ionic components of the surface chemistry of the slab (the top 0 - 3/16"(5mm)), when present at certain levels, can cause a failure to occur.

Concrete defects resulting from alkaline-silicate reaction (ASR) or alkaline-aggregate reaction (AAR) within the slab may also contribute to floor failure.

How do I test my floor?
Dur-A-Flex has developed a chart to assist you with identifying the moisture limits for each type or Dur-A-Flex resin/flooring system. If you are planning to use our Epoxy or MMA, Dur-A-Flex recommends using in-situ Relative Humidity Testing per ASTM F-2170 as a quantitative test method. Although traditional calcium chloride testing may be used, RH differs in that it is not significantly impacted by ambient temperature and relative humidity conditions in the building and thus likely to provide more accurate readings. The use of calcium chloride testing on lightweight concrete on elevated decks is not recommended.

In cases where a product can tolerate high levels of moisture such as Poly-Crete, Hybri-Flex or Dur-A-Glaze MVP, Dur-A-Flex may recommend that cores be taken and analyzed to determine the levels of ionic components (salts) in the slab. Dur-A-Flex offers in-house core testing using ion-chromatography technology. Refer to the Dur-A-Flex Core Analysis Program on our website for more information.

Note: Test results from cores taken after osmotic blistering has already occurred may not be accurate due to the ionic components transferring from the substrate to the blisters.

Dur-A-Flex Floor Evaluation Guidelines

Resin system	EPOXY	MMA	URETHANE		HYBRIDS	MITIGATION
Product Group	Dur-A-XXX, Shop Floor	Cryl-A-Flex	ACCELERA™	Poly-Crete®	Hybri-Flex®	Dur-A-Glaze MVP Primer
Calcium Chloride (CaCl) - lbs. maximum per 1,000 SF per 24 Hrs. (per ASTM F1869)	3	5 (with bond test)	3	20*	20*	20*
Relative Humidity (RH) - % maximum (per ASTM F2170)	75%	85% (with bond test)	75%	99%*	99%*	99%*

	* POLY-CRETE, HYBRI-FLEX and DUR-A-GLAZE MVP
Old Concrete (>1 yr. old)	Core analysis testing is recommended to rule out the potential for osmotic blistering caused by higher than normal levels (see below) of soluble ion (salt) deposits at or near the surface. Refer to the Dur-A-Flex Core Analysis Program.
New Concrete (<1 yr. old)	Core testing is not required if NO concrete curing compounds, hardeners, or densifiers were used. The use of any of these products may cause soluble ion (salts) deposits at or near the surface to exceed normal levels (see below), potentially producing conditions for osmotic blistering. In these cases Dur-A-Flex recommends a core analysis to determine if these levels are suitable for an installation. Refer to the Dur-A-Flex Core Analysis Program.

The following data is based on testing of a concrete substrate profiled per Dur-A-Flex Surface Preparation Guidelines and free of any contaminants that could increase levels of the soluble ions listed. This data is to be used as a guide only. Please contact your local Dur-A-Flex Sales Representative or the Dur-A-Flex Technical Departments for a thorough analysis of your results.

Normal Soluble Ion Levels in
<u>Substrate (parts per millions)</u>

Sodium (Na)	~200-800 ppm
Potassium (K)	~200-800 ppm
Chloride (Cl)	~10-100 ppm
Sulfate (SO4)	~1500-5500 ppm

Pre-installation Acceptable Soluble Ion Levels
in Substrate by Product (combined Na, K, Cl)**:**

Epoxy, MVP, MMA , ACCELERA	1600 ppm
Poly-Crete SLB, MD, HF (w/topcoats), Hybri-Flex E, M or A	3200 ppm
Poly-Crete MD, HF (no topcoats)	4800 ppm

In all cases, Dur-A-Flex, Inc. products must be applied as per Dur-A-Flex Application Instructions on structurally sound and clean areas in which the concrete meets acceptable industry standards as defined in ACI Committee 201 Report, “Guide to Durable Concrete.” Dur-A-Flex shall not be liable for bond failures caused by deficiencies in the substrate including, but not limited to, the presence of ionic compounds or soluble salts, alkali silicate reaction, alkali aggregate reaction, shale-pop, and other expansive reactions of aggregates and reinforcements. Dur-A-Flex recommends all concrete be tested for quality by a licensed petrographer.