Q On a basement remodel, the existing CMU foundation had a lot of efflorescence. We added foundation waterproofing and corrected the drainage to deal with the moisture issues. Do we need to remove the efflorescence before we finish the walls with rigid foam, 2x4 framing, and drywall?

A Foster Lyons, an engineer and building-science consultant, responds: One of the saving graces of concrete block (CMU) is that it is extremely porous. CMU is more like no-fines concrete than brick or normal-weight concrete. In fact, this material is so porous that it puts up almost no resistance to the movement of water. That's one of the reasons you typically see basement interior efflorescence on the CMU and not on the mortar between the blocks. Water is leaving the assembly through the CMU rather than through the mortar (see photo, right). Mother Nature always takes the path of least resistance, and when the water exits, it leaves behind dissolved salts (efflorescence) on the surface of the block.

Do those salt deposits pose a problem? Not really. CMU is so porous, internal osmotic pressures don't build up the same way they do in brick and normal-weight concrete. In brick and normal-weight concrete, the pore structure is so small that osmotic pressure caused by the salts on the exterior surface can break the material, causing structural damage. But the extremely porous structure of CMU means no internal pressure and therefore no structural damage.

With the new waterproofing and drainage measures for the foundation, the amount of available water has been greatly reduced. The salt in the CMU is not unlike mold—without water, the problem doesn't exist. And speaking of mold, the salt that leaches out of CMU in the efflorescence process does a pretty good job of dehydrating and killing mold spores. So in that regard, the salt deposited on the wall acts as a good anti-fungal agent.

However, that salt will attract water in both liquid and vapor form. Mother Nature doesn't like this type of salt concentration and will try to dilute it. The salt acts to pull water from whatever source it can—the CMU, the ground, the footing, the interior air—to self-dilute. For this reason, I suggest removing this salt. Don't worry about being too thorough. Just stiff-brush the salt from the wall, sweep it up, and throw it in the trash. That treatment won't remove every last speck of salt, but it will take care of the bulk of it. I don't recommend acid washing the wall or wet washing it in any way. Using water to remove the salt only adds water to an assembly that you would prefer to keep perfectly dry.

More critical than removing the salt crystals from the CMU is air-sealing the interior rigid insulation. Tape the rigid insulation at all joints, and seal along the top and bottom edges with caulk. This air-sealing will reduce the potential for condensation behind the new rigid insulation by preventing warm, moist interior air from coming in contact with the cool surface of the CMU.

Some moisture may still get through the CMU, and it needs a way to dry. About the only way for water vapor to exit is through the interior insulation, so don't prevent it. If the home is in climate zone 3 or below, any rigid insulation with a perm rating above 0.1 will work. If the home is in climate zone 4 or above, the insulation should be "vapor semi-impermeable" (greater than 0.1 perm but less than 1.0) or "vapor semi-permeable" (greater than 1.0 but less than 10). Do not rely on "vapor permeable" (greater than 10 perms) insulation—such as fiberglass only—in the 2x4 interior wall in climate zone 4 or above where there is a risk of condensation on the above-grade section of the foundation wall.

Photo by Foster Lyons

Unsightly salt. White deposits on concrete block are salts that leach from the block as moisture passes through. The deposits don't do any structural damage to the block, but should be dry-brushed off and thrown away.

Q How long does it take a fresh concrete slab to dry out before flooring can be put down?

A Bill Palmer, editor at large for *Concrete Construction* magazine, responds: Contractors are correct to be concerned about moisture in a new concrete slab when installing wood flooring or moisture-sensitive impermeable flooring over one. Every year, hundreds of floors suffer damage—including delamination, blistering, warping, staining, and mold growth—from moisture that comes from the concrete underneath. Unfortunately, so many factors affect drying time for concrete, there is no chart to consult. Variables include ambient relative humidity, permeability of the concrete, amount of water in the concrete when placed (water-cement ratio), slab thickness, presence or absence of a vapor barrier in contact with the slab bottom, and the method used to finish the surface (hard troweling can create a barrier to drying). Each one can affect how much time drying might take.

For most impermeable flooring (like vinyl or linoleum), the goal is for the concrete to reach an internal relative humidity of about 85% or surface moisture-vapor emission rate (MVER) of 3 to 5 pounds of moisture per 1,000 square feet over 24 hours. For wood floors, the National Wood Flooring Association recommends 75% internal RH and an MVER of 3 pounds per 1,000 square feet over 24 hours. Under typical drying conditions, with the ambient RH around 50% most of the time, temperatures above 65°F, concrete w/c ratio of 0.5, and a 4-inch slab, drying to an 85% RH level should take three to four months. But remember that the clock starts when the surface is dry. If the slab gets wet (such as being rained on), the drying time can be extended.

The ambient RH can have a huge effect on drying. In Florida in the summer with an ambient RH of 90%, the slab can never dry down to 85%. In many parts of the U.S., getting the RH to 75% may be difficult without closing in the building and operating the HVAC system.

The easiest way to determine the internal RH of the slab is to test. A couple of fairly simple tests are available: the calcium-chloride test to measure surface moisture emission rate (ASTM F 1869), and the internal RH test (ASTM F 2170). I strongly recommend the latter. Don't be tempted to use electrical-resistance moisture meters (like you would use with lumber). These testers can indicate differences in moisture from one part of a slab to another, but they don't tell you anything about overall moisture.

One of the most important factors governing the moisture content in a slab is presence of a vapor barrier (or retarder) in the assembly. Years of testing have shown conclusively that the relative humidity of the ground beneath a concrete slab—whether in Arizona or New England or Florida—is 100%. If there's no vapor barrier, the slab will never dry out. So the best location for the vapor barrier is in direct contact with the bottom of the slab to take ground moisture out of play. Some years back, the consensus was to put the vapor barrier under a sand "blotter" layer, but the sand simply acted as a reservoir for moisture. The best-quality vapor barrier is a poly sheet with a thickness of at least 10 mils, preferably 15 mils. Lap and tape any seams, and seal around any openings.

If insulation is used over the concrete (as in "Insulating Over a Slab," Jun/18), a four-month drying time should be adequate before installing EPS. With the vapor barrier placed in the right location, the EPS insulation will absorb some moisture, but not a lot (about 0.5% by volume, according to the EPS Industry Alliance). On the project in the article, the double layer of OSB (with its perm rating of 1) will also serve to keep moisture from migrating from the slab to the flooring. Another strategy for projects such as that one is applying a moisture-mitigation coating directly on top of the concrete. A poly barrier could also be used on top of the concrete, but the chances of it being damaged during construction would be high.